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ABSTRACT

A study sought to determine the extent to which mathematics content in tech prep programs in New York state matched or differed from the content of the three Regents college preparatory courses. Data were gathered through questionnaires received from a sample of 24 of the state's 30 tech prep consortia providing information about 27 curricula. Some of the results included the following: (1) almost 60 percent of the tech-prep mathematics curricula reported using only applied courses and no college preparatory sequential mathematics courses; (2) only two mathematics curricula were integrated into other subjects rather than being given as separate courses; (3) 20 percent of the tech prep programs included either 2 or all 3 of the Regents college preparatory mathematics courses; (4) the curricula typically covered just over 40 percent of the topics in the Regents curriculum; (5) agreement with State Framework Math Statements was substantial; and (6) anticipated changes to be brought about by various legislation and technology changes will have an impact on the curricula of the tech prep schools. (The report includes 31 tables and figures representing the topics covered in the various mathematics courses in the tech prep schools and in the mathematics framework.) (KC)

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TECH-PREP MATHEMATICS IN NEW YORK STATE

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U.S. DEPARTMENT OF EDUCATION
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September 1995

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S. M. Brodsky, September 1995

TECH-PREP MATHEMATICS IN NEW YORK STATE

EXECUTIVE SUMMARY

This study was designed to determine the extent to which mathematics content in Tech-Prep programs matched or differed from the content of the three Regents college preparatory courses. In addition, the applicability to Tech-Prep mathematics curricula of statements in "Framework for Mathematics, Science & Technology" was measured.

Secondary school mathematics was studied in a sample of Tech-Prep programs in New York State. Useful responses were received from 24 of the State's 30 Tech-Prep consortia providing information about 27 curricula on two extensive questionnaires and a brief follow-up questionnaire.

One questionnaire listed 317 mathematics topics taken from the Regents college preparatory curriculum series of three courses, with 89 topics from Sequential Math Course I, and 114 topics each from Sequential Math Courses II and III. Respondents were asked to indicate whether a topic was not included in the Tech-Prep program (NO), was optional or the respondent was uncertain (?), or was included (YES). For items answered YES, an estimate of the clock hours devoted to that topic was asked for.

A second questionnaire listed 92 statements taken from the "Framework for Mathematics, Science & Technology" which is in draft form and was distributed for discussion by the New York State Education Department in mid-1994. These statements are grouped into 8 broad subject areas. While the State document provides statements at three levels, elementary, intermediate and commencement, only the latter two were included in this questionnaire.

The following are among the more interesting results.

- Almost 60 percent of Tech-Prep mathematics curricula reported using only applied courses and no college preparatory Sequential Math Courses.
- Typical applied course titles were Tech-Prep Math and Applied Math. Only two math curricula were integrated into other subjects rather than being given as separate math courses.
- Another one-fifth of the Tech-Prep curricula reported including Sequential Math

Course I along with additional applied mathematics.

- The remaining one-fifth included either two or all three of the Regents college preparatory math courses.
- The curricula with no Sequential Math Courses exhibited a wide range in the percentage of topics covered with an overall median of just over 40 percent. The typical curriculum included 65 of the 89 topics from Sequential Course I and another 65 out of 228 topics from the other two Sequential Courses, totaling 130 topics. Most of these applied courses avoided proofs and derivations, but devoted more hours to the topics than traditionally allotted. In many cases, these curricula covered additional math topics, not included in the Sequential Courses, as well as other topics relevant to the technical curriculum.
- The curricula which included Sequential Math Course I, also tended to include a larger number of topics from the other two Sequential Courses, with median coverage of over half of the Sequential Course II topics and two-fifths of the Sequential III topics. While these curricula also showed a rather wide range, the typical curriculum of this type was clearly closer to the Regents course topical series (overall median coverage of about 60 percent) than those with no Sequential Courses.
- Mathematics topics were also grouped into the following subject areas, which mirrored the groupings of the statements in the State Mathematics Frameworks.

  Logic topics
  Number Sense & Numeration Concepts topics
  Operations on Number topics
  Geometry topics
  Measurement topics
  Probability & Statistics topics
  Algebra topics
  Trigonometry topics
  Other topics not included above

- For the curricula with no Sequential Courses, the three subject areas with the lowest median percentage coverage were Logic (25%), Geometry and Trigonometry (31% each). The three areas with the highest median percentage coverage for these

curricula were Measurement (75%), Numeration Concepts (69%) and Operations with Number (66%). However, the four subject areas with the largest number of topics covered in all groups were Algebra, Geometry, Trigonometry and Probability & Statistics which accounted for almost 80 % of the topics. Similar median percentage and numerical trends were noted for the curricula with one Sequential Math Course.

- One or more curricula with no Sequential Courses included 299 of the 317 topics listed and required approximately 25 percent more class time than was judged to be used in Sequential Courses for these same topics. Semester class time for a Sequential Math Course is traditionally 120 clock-hours, but Tech-Prep applied math courses ranged from 120 to 200 clock-hours with a median of about 140 hours.

- Curriculum developers can use the subject area Tables 6 through 14 to find, for each of the 317 topics, the number of Tech-Prep curricula with no Sequential Math Courses which include that topic and the median number of hours reported for each compared with a set of "standard" hours. In addition, for these same curricula, Table 15 lists by subject area those topics which are included in 75 % or more curricula and 25 % or fewer curricula; i.e. the most often and least often used topics in Tech Prep.

- Agreement with State Framework Math Statements was substantial with an overall median of 87 percent for the curricula with no Sequential Courses and 91 percent for those with one Sequential Course. The three subject areas with the lowest percentage agreement for those with no Sequential Courses were Logic (44%), Probability & Statistics (66%) and Geometry (77%). All other subject areas had median agreement percentages from 96% to 100%. Evidently, those involved with applied curricula may agree with many of the broader Framework statements even though coverage of specific topics may vary.

- Readers who are interested in the detailed responses to the State Framework Math Statements will find that information in subject area Tables 19 through 26. In addition, Table 27 lists those Framework Math Statements which received 50 % or less agreement from respondents.

- Several anticipated changes in Tech-Prep curricula are outlined in the Discussion section. In addition, that section also treats the issue of curriculum decision rules which may result in diverse mathematical curricular content.

TECH-PREP MATHEMATICS IN NEW YORK STATE

BACKGROUND

Tech-Prep is a national program as part of the Vocational & Applied Technology Education Act (VATEA) which encourages secondary and post-secondary institutions to form consortia to create applied curricula which smoothly connect the 11th and 12th grades through an associate degree in career fields. The legislation also allows equivalent apprenticeship programs in lieu of associate degrees but the programs in this state have focused on associate degree goals and beyond. The program fosters close working relationships between high school and college faculty and counselors including joint training, planning and curriculum development. Tech-Prep normally includes development of workplace readiness skills, career education and exploration, initial stages of workplace learning, educational preparation for rigorous associate degree technical programs, and often opportunities for advanced standing through attending college level work prior to completing high school.

The New York State Education Department launched Tech-Prep as part of the newly reauthorized VATEA in 1991 when seven consortia were funded. In subsequent years, an additional seven, then fourteen and finally two consortia were approved giving a total of 30 operating consortia, geographically distributed across the state. In addition, two Tech-Prep Technical Assistance Centers have been supported, one at the Two-Year College Development Center at the State University of New York (SUNY) in Albany, and the other at the Center for Advanced Study in Education (CASE) at the City University of New York (CUNY) Graduate School in New York City.

The New York State Education Department was interested in assessing how applied curricula in core subject areas compared with content in college preparatory courses. A Technical Assistance Center Advisory Committee consisting of Tech-Prep Consortium Project Directors endorsed the idea and recommended starting with mathematics. The CASE Technical Assistance Center was asked to carry out this study.

THE STUDY

Each of the 30 Tech-Prep Consortium Project Directors was asked to select an experienced mathematics person who was familiar with their Tech-Prep curriculum to participate in the study. Those identified were sent two extensive questionnaires and detailed instructions for completing them. In addition, the author spoke to each of the potential respondents as well as the 30 Project Directors to ensure that the materials were understood and that the math person would be able to respond in a timely manner. A total of 25 respondents from 24 of the state's 30 (80%) Tech-Prep consortia provided useful information about 27 different Tech-Prep curricula. The remaining consortia did not participate either because there was no available respondent or because their math curriculum was not sufficiently developed to provide complete responses to the questionnaires.

One questionnaire consisted of a listing of math topics from the three Regents college preparatory courses in the state. These courses are officially designated as a "Three Year Sequence for High School Mathematics, Courses I, II & III". In this study, these courses will be called "Sequential Math Courses I, II and III" or variations of that terminology. The topics in the questionnaire were listed by Sequential Course with 89 topics associated with Sequential Math Course I, and 114 topics for each Sequential Math Course II and III; a total of 317 items. For each topic, the respondent was to indicate by check mark if the topic was not included in the Tech-Prep math curriculum (NO), if the topic was either optional or the respondent was uncertain about it (?), or if the topic was included in the Tech-Prep curriculum (YES). For each YES response, the number of clock-hours used for that topic in the curriculum was to be estimated to the nearest quarter hour.

The list of topics was taken from the 1988 New York City revision of Sequential Courses 1, 2 and 3, which detailed lesson topics numbering 120, 120 and 130, respectively. This source was selected over the New York State syllabi for these courses because the latter were subdivided into many more topical items. Although the state

syllabi were more recent, use of the New York City version limited the length of the content questionnaire while covering essentially the same material.

The topics were listed on the questionnaire in the order they appeared in the source noted above. After the questionnaires were distributed to the various consortia in early February 1995, three mathematics experts provided a classification of these items into 9 subject areas:

Logic
Number Sense & Numeration Concepts
Operations on Number
Geometry
Measurement
Probability & Statistics
Algebra
Trigonometry
Other

Responses to the questionnaire were subdivided and analyzed by Sequential Math Course from which the item was drawn and by subject area classification.

An expert in secondary mathematics assigned hours normally needed to cover each of the topics in each Sequential Math Course with instructional hours totaling 120. These hours represented a math course meeting for 180 instructional days in 40 minute periods each day. These hours were designated as "standard" hours and were used for comparison with those reported by the respondents.

The items in the topics questionnaire were arranged in three sections. Items 1 through 89 were from Sequential Math Course I, items 90 through 203 were from Sequential Math Course II, and the last group from Sequential Math Course III were items 204 through 317. To simplify the respondent's task, those whose Tech-Prep curricula included any of the Sequential Math Courses were instructed to skip the corresponding section of the questionnaire. Thus, the four respondents who reported that their Tech-Prep curricula included all three Sequential Math Courses did not need

to give information for any of the 317 topical items.

The second questionnaire incorporated 92 statements from "Framework for Mathematics, Science and Technology" issued by the New York State Education Department as a draft for discussion. The statements, as issued, are given in three levels; elementary, intermediate and commencement. Statements from the latter two levels were included in the questionnaire as being appropriate to secondary grades 9 through 12.

The Framework statements were organized, in the publication noted above, into 8 subject areas:

Logic
Number Sense & Numeration Concepts
Operations on Number
Geometry
Measurement
Probability & Statistics
Algebra
Trigonometry.

The items in the topics questionnaire were classified into the same set of subject areas as the Framework statements after the topics questionnaire was distributed.

Respondents were asked to indicate for each statement if it applied to their curriculum (YES), if it did not apply to their curriculum (NO), or if they were uncertain (?).

A brief follow-up questionnaire solicited information about the number of separate mathematics courses in their curricula, the course titles, the time devoted to each course, and for integrated math, the subjects with which it is included.

ASSUMPTIONS

This study is delimited by the following assumptions.

- All respondents were math professionals who were involved in one or more Tech-

Prep curricula and completed the questionnaire using their best professional judgement.

- The topics listed in the questionnaire accurately describe the essential content of the Sequential Math Courses I, II and III.
- All topics in the questionnaire can be treated as though they are numerically equal in importance to facilitate quantification. The question of interest here is the comparison of the extent of coverage of the content of Sequential Mathematics courses. For this purpose, no consideration of the relative importance was made, and they were not weighted but rather treated as equal.
- All topics listed in the questionnaire for a given Sequential Math Course were included when such courses were taught in their entirety as part of a Tech-Prep curriculum.
- The "standard" hours assigned to topics in Sequential Math Courses in this study accurately reflect the time distribution in such courses generally and these hours apply when such courses are taught in their entirety as part of a Tech-Prep curriculum.
- All Framework statements can be treated as though they are numerically equal in importance to facilitate quantification, rather than being weighted in some way.
- Both the intermediate and commencement levels of the State Framework statements are applicable to secondary mathematics curricula.

FINDINGS

The 27 Tech-Prep curricula reported fall into four different categories as shown in Table 1. About 60 percent of the curricula (Category A) do not require any Sequential Math Courses, but include applied mathematics instruction. Another 18.5 percent (Category B) included Sequential Math Course I, usually with additional applied mathematics instruction, while the remaining curricula included either two (Category C) or three (Category D) Sequential Math Courses.

The respondents reported that applied mathematics instruction was most often offered in separate courses with a variety of titles, the most common of which were Tech-Prep Math and Applied Math. Only two programs had the math integrated into

other subjects rather than in separate math courses. Approximately half of the curricula use materials developed by the Center for Occupational Research & Development (CORD) of Waco, Texas either as the primary instructional material or as a supplement to texts or teacher-made material. Most of the others rely on textbooks, including all of the Category C & D, most of the Category B and several of Category A curricula. A list of the instructional materials reported, including the titles of the 40 CORD units, is shown in Table 17.

COVERAGE OF TOPICS FROM SEQUENTIAL MATHEMATICS COURSES

Table 2A shows the range and median of the number of topics from the Sequential Math Courses which are covered in the 16 Category A Tech-Prep mathematics curricula; those with no Sequential Math Courses. Also given is the median of the percentages of topics covered which is determined by dividing the median number of topics covered by the total number of topics in that group. See the example in the footnote to Table 2A which shows that the median Tech-Prep curriculum in Category A covered about three-quarters of the Sequential Course I topics. This table shows the extremely broad range of topical coverage within this category. Note that while a median of three-quarters of the topics from Sequential Course I are covered in Tech-Prep curricula, this measure drops to one-third for Sequential Course II topics and to less than one-quarter for Sequential Course III topics. Overall, a median of about two-fifths of the topics are covered. Thus, the typical Category A curriculum includes about 65 topics from Sequential Course I, and another 65 topics from Sequential Courses II and III, totaling 130 topics from college preparatory courses. The corresponding data for Categories B and C are shown in Table 2B and 2C. The median curriculum with one Sequential Math Course (Category B) appears to incorporate about three-fifths of the college preparatory topics, while those with two Sequential Math Courses (Category C) show almost 90 percent coverage. Note that is was assumed that all topics listed for Sequential Math Courses were covered in those Tech-Prep curricula which included specific Sequential Courses. These latter two categories (B and C) include very small numbers of programs, 5 and 2, respectively,

which suggests the probability that these data may be unreliable. Category D curricula were assumed to cover all 317 topics in the three Sequential Math Courses which they include and therefore no separate table for Category D topics was needed. Variations from the assumption of full topical coverage when Sequential Math Courses are given as part of Tech-Prep curricula may occur in some cases but were not measured. A comparison of the median data from Tables 2A, 2B and 2C is shown graphically in Figure 1. Category D curricula are represented by bars which reach the 100 percent level. Category C data start at 100 percent for Courses I and II and then drops to 68.4 percent for Course III. Category B data start at 100 percent for Course I and then drops to 52.6 and 36.0 percent. While tech-prep math curricula with no Sequential Courses cover only a fraction of the topics in the college preparatory courses, the tech-prep math curricula cover additional topics in math and other areas relevant to the technical curriculum; see Table 16.

Coverage of Topics by Subject Area

The 317 topics from the three Sequential Math Courses have been subdivided into nine subject area classifications as shown in Table 3. In order of total number of topics, Algebra and Geometry predominate with more than half of the topics (91 and 87, respectively), followed by Trigonometry (39), Probability & Statistics (34), Logic and Operations on Number (20 each), Number Sense & Numeration Concepts (11), and Measurement (7). Eight topics were classified as Other.

The range, median numbers, median percentages and size ranks of subject area topics covered in Tech-Prep curricula for Categories A, B and C are shown in Table 4. The rank order of all 317 topics is somewhat different than the rank order of topics covered in Tech-Prep curricula. While Algebra and Geometry continue to dominate as 1st and 2nd ranks, the remaining size rankings in Category A are different than for Sequential Courses. Probability & Statistics, Number Sense & Numeration Concepts, and Measurement all moved up one rank position to 3rd, 6th & 7th, respectively, while Logic dropped back more than two positions to 8th and Trigonometry moved one position down to 4th. Rankings for Category A and B were

similar except that in Category B Logic was down one-half position to 6th and Numeration and Measurement were tied for 7th. Category C which included two Sequential Courses matched the Sequential Course rankings with one small exception.

TIME ALLOTMENT COMPARISON: TECH-PREP VS. TRADITIONAL COURSES

The median number of hours devoted to Tech-Prep topics in each subject area compared to the "standard" hours for the same topics is shown for Category A curricula in Table 5A. In this table and the two which follow, the number of topics listed for each subject area are those which are included in one or more Tech-Prep curricula of the corresponding category. Thus, if a topic in the questionnaire is not represented in any Category A curriculum, it is not included in this table and neither are its "standard" hours or Tech-Prep hours. Furthermore, responses which indicated that a topic was included in the Tech-Prep curriculum but provided no time estimate were included in the No. TP TOPICS column but were not involved in either "standard" hours or medians. These Tech-Prep programs appear to spend more hours than the "standard" hours for each group of topics. The percentage of increased time in Table 5A for each Sequential Course group of topics is +22.6 % for I, +33.8 % for II and +16.2 % for III, with an overall increment of +23.7%. This last number can be seen in the TOTAL line under % TP MEDN, shown as 123.7. The percentage hourly increments are calculated from the TOTAL line by dividing TP MEDN by STAND. Certain Tech-Prep subject areas appear to involve from 70 to 100 percent more time than Sequential Courses; Number Sense & Numeration Concepts (+100 %), and Operations on Number and Measurement (+70 % each), although taken together these three subject areas represent relatively few topics. Ten percent fewer median hours than "standard" are devoted to Probability & Statistics by Category A curricula which may imply somewhat briefer coverage with less problem solving time than is given proportionately to other topics. The three mathematics subject areas to which these Tech-Prep programs appear to devote the heaviest time commitments are Algebra, Geometry and Trigonometry. These topics together account for 66 percent of total Tech-Prep math course time, and exceed Sequential Course "standard" hours by about

one-fifth for Algebra and Geometry, and by about one-third for Trigonometry.

Table 5B for Category B curricula, shows the time devoted to Tech-Prep topics compared to "standard" hours. Note that the assumed time for topics in Sequential Math Course I, which these Tech-Prep Category B curricula include, is equal to the "standard" time. Therefore, the hours listed for Sequential Course I under the heading TP MEDN are the same as those listed under STAND, as are both column totals. However, the Tech-Prep median time allocations for Sequential Courses II & III topics which total 135.9 and 112.6 hours, respectively, exceed the "standard" hours of 109.8 and 100.8 by +23.8 % and + 11.7 %, respectively, with an overall increment of + 11.5 %. This difference is half as much as for Category A programs and may be attributed to the inclusion of Sequential Math Course I in Category B programs which eliminates the time differential for the first 89 topics. Note that the largest increment is for the Sequential Course II topics, which was true of Category A as well. For these five Category B curricula, the largest subject matter hourly median increment was in Logic (+31.9 %), followed by Trigonometry (+19.7 %) and Geometry (+17 %). The major time allocations were for Algebra, Geometry and Probability & Statistics which together accounted for almost 70 percent of the hours in the median Tech-Prep math curriculum.

Table 5C shows only the overall data for two Category C curricula which include Sequential Courses I & II in the Tech-Prep math program. The hourly allocations for the two Sequential Course topics were, once again, assumed to be the "standard" hours. Therefore, the only effect on the overall increment comes from the Sequential Course III topical hours. With an overall increment of +11.9 %, topics for III contributed a surprising +36.5 % more time than Sequential Course III topics. This may be partially explained because most of the Trigonometry topics appear in the III group of topics which show a median increment of +58.3 % over "standard" hours. Trigonometry combined with Algebra and Geometry command almost 70 percent of the median Tech-Prep hours for this category.

Figure 2 shows graphically the relations between the median percentage time allocations for topics in all four categories of Tech-Prep curricula. Category A & B

curricula appear to follow somewhat similar patterns with higher incremental hours devoted to Sequential Course II topics. One would have expected the increment for Category C in group III topics to have been closer to those of the other two categories; i.e. somewhere near +10 to +15 %. Instead, an increment of almost triple the expected number was found. While this may be partially explained as noted above, these data come from just two programs which were the only Category C curricula reported by respondents in this study. Therefore, this result may not be typical of the group.

CURRICULUM ANALYSIS BY SUBJECT AREAS AND TOPICS

In order to provide Tech-Prep mathematics curriculum developers with a maximum of useful information, the 317 topics used in this study are arrayed by subject area in Tables 6 through 14. Individuals may differ with the classification of topics into the subject areas shown, but the data for each topic represent the responses from math professionals who were unaware of the subject area classification when they responded.

The participants in the study and the 30 Tech-Prep Project Directors in New York State should have a copy of the topics questionnaire and those who responded would have copies of their own completed questionnaires. To relate the following nine tables to a copy of a completed questionnaire, it will be useful to number the items from 1 to 317, consecutively. There is no need to number a blank topics questionnaire nor does one need a blank questionnaire since all 317 topics are identified in Tables 6 -- 14.

These nine tables reflect the data for the 16 curricula in Category A, that is, those Tech-Prep math curricula with no Sequential Math Courses. Tech-Prep personnel whose curricula fall into Categories B or C might simply use the less detailed data in Tables 4, 5B and 5C, or examine the appropriate group topics from II and or III in Tables 6 through 14. Each of these nine tables gives for each topic in one subject area, the number of curricula and the percentage of the 16 programs for which respondents checked YES, indicating that the topic was being covered in their Tech-Prep math program. In addition, the assigned "standard" hours are given for each topic, the range of Tech-Prep hours reported for each topic and the median Tech-Prep hours for each topic. Since not all respondents who checked YES for a topic provided time estimates,

the median hours were determined from those reporting the time, which may have been fewer curricula than the number of YES responses.

Tech-Prep math study participants and consortium Project Directors who have their completed questionnaires may want to compare their responses with these tables for several possible purposes, for example:

- To see how their program compares with the statewide patterns
- To examine whether to include or delete a series of topics based on what others have done
- To adjust their time allocations for certain topics or subject areas
- To broaden the coverage of their program, where warranted
- To include or delete Sequential Math Courses, or
- To provide a basis for seeking Regents credit recognition for applied math courses via the variance process.

Others who did not participate in this study might simply work from the data provided herein to accomplish some of the same objectives mentioned above.

Table 15 provides a listing of the topics used by 75 percent or more of the Category A curricula (12 or more of the 16) and the topics used by 25 percent or less of the Category A curricula (4 or fewer of the 16) of the 317 used in this study. In viewing this table, one should keep in mind that more than 100 of the topics used in Tech-Prep curricula are not shown on Table 15. The largest contribution to the topics in this table which are used less often comes from topics involving proofs or derivations, which many Tech-Prep math curricula minimize to allow for emphasis on applications and additional topics related to specialized mathematics or a technical field.

ADDITIONAL TOPICS INCLUDED IN TECH-PREP PROGRAMS

Table 16 lists some of the additional topics used in Tech-Prep math curricula. Not all respondents provided information about such topics, but one would suspect that most Tech-Prep math programs do include some additional instructional topics. The largest group of items in this table were in mathematics. Although a few were actually in the questionnaire list, some represented either advanced or specialized math topics.

In the technology group, items were related to manufacturing, drafting, surveying, electronics, and health careers. A number of items dealt with applications of computers and calculators, while others focused on measurements and instrumentation.

INSTRUCTIONAL MATERIALS

Table 17 lists some of the instructional materials which were reported. The most widely used material is from the Center for Occupational Research & Development (CORD) which has been adopted in whole or part in 13 of the 27 curricula in this study. This material is organized into 40 units, as shown in Table 17, 36 of which were available at the beginning of the 1994-1995 academic year. The units come with a variety of back-up media and lab instruction. There are enough units to support three applied math courses and several of the curricula have done precisely that.

Eleven of the curricula reported using particular textbooks. Specific texts were reported used by 4 Category A, 2 Category B, 2 Category C and 3 Category D curricula. Many of the textbooks listed in Table 17 were either supplemented by other materials or were themselves supplementary. There does not appear to be very many texts which would directly support Tech-Prep programs, perhaps because of the variety of activities which are normally included in such programs as well as the tendency to avoid single source and print-only instructional materials.

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS

Table 18 shows the extent of the reported agreement of these Tech-Prep curricula with the Framework statements. The median percentage agreement with statements exceeded 85 percent over all 27 programs. The statements were classified by subject area in the Framework document and were taken from the intermediate and commencement levels, as noted earlier. Each statement was treated numerically equally. The statements in the five subject areas of Algebra, Trigonometry, Number Sense & Numeration Concepts, Operations on Number, and Measurement produced strong agreement from the typical (median) respondent with either complete agreement or nearly so. The statements for the subject area of Logic showed a median agreement of only 50 percent. Curricula with Sequential Math Courses typically showed

substantial agreement with the Framework statements. In general, the respondents were much more likely to check YES for a Framework statement, indicating that the statement applied to their curriculum, than for a Sequential Math Course topic, which would have indicated that the topic was part of their curriculum. This finding would imply that the Framework mathematics statements apply broadly to Tech-Prep programs with notable individual exceptions.

The dispersion of Tech-Prep math curricula reported when measured by both the percentage of Sequential Math Course topics covered and the percentage agreement with the Framework statements is shown graphically in Figure 3. Note that those programs which include all three Sequential Math Courses come close to perfect matches with the Frameworks while they were assumed to match the college preparatory topics. Many of the Category A curricula cluster around the median data for both of these variables, although a few show lower matching percentages on both variables. While there were only two Category C curricula reported, they both showed somewhat lower Framework agreements than the Category B programs and many of the Category A programs.

Tables 19 through 26 show the responses to each of the Framework statements, with each table covering one of the eight subject areas. Within each table, the responses from Category A curricula (those with no Sequential Math Courses) are given separately and the other categories (B, C & D) are grouped. In each set of subject area data, the number of responses and the percentage of the total (for that group) which agreed that the statement was appropriate to the Tech-Prep math curriculum (YES), the number that disagreed (NO), and the number of uncertain responses (?) are given for each statement. The statements shown in these tables have been substantially abbreviated in order to limit each to one line in the tables. The statements which were given in the questionnaire were much more elaborate and represented the published Framework statements closely. If one is interested in the applicability of any of the Framework statements to Tech-Prep mathematics curricula, these eight tables will provide that information.

Table 27 shows selected Framework statements which received 50 percent or

fewer YES responses from either the 16 Category A curricula or the 11 group of responses from Categories B, C & D combined. The latter grouping represents all those programs with at least one Sequential Math Course. Of the 12 statements listed which received 50 percent or fewer YES responses, Logic and Geometry each had 4, although one of the Probability & Statistics statements was the only entry in the Category BCD column. Several statements seemed to cause respondents some uncertainty with numbers of responses (grouped for all 27 ABCD curricula) ranging from 4 to as high as 7. These are listed in the No. ? column in Table 27. It is likely that some statements may have caused confusion and perhaps need revision, although the uncertainty about "Validate formulas used to compute measurements" is surprising.

DISCUSSION

A good deal of previously unmeasured information has been gathered from knowledgeable mathematics professionals regarding the nature and content of Tech-Prep mathematics curricula in New York State. While these data are believed to be accurate for the spring 1995 semester, it is clear that several changes are in process giving these programs a dynamic element. Among these anticipated changes are:

- The new School-To-Work Opportunities Act which will impact Tech-Prep curricula in several predictable and other unpredictable ways. A number of the New York State Tech-Prep consortia are involved in School-To-Work partnerships which may change the way they operate. There will undoubtedly be an increase in workplace learning which might include some elements of the mathematics curricula.
- The increasing use of calculators will impact the way in which certain topics are taught. This year, scientific calculators are to be used in Regents exams. One expects that there will be changes in the "standard" time distributions and the relative importance of topics.
- In New York City, the Board of Education has approved a change which will phase in a requirement that all students take the Sequential Math Courses. This coming fall (1995) the requirement for Sequential Math Course I will be implemented and the

others will follow in successive years. Currently, two of the five New York City Tech-Prep consortia include Sequential Math Courses (Category D; all three Sequential Courses) and shortly they will be joined by the other three.

- Approximately half of the respondents reported using math instructional materials produced by the Center for Occupational Research & Development (CORD) either solely or as supplements to texts or other materials. Several respondents noted that they were awaiting one or more of the new units which CORD had under development at the time they responded to this study. The units mentioned specifically were Logic, Coordinate Geometry, and Transformations, all of which showed limited current inclusion in the math curricula, particularly in the Category A (no Sequential Math Courses) programs.

- Several Tech-Prep programs are in their 4th or 5th years of operation and are planning to institutionalize their programs or have done so in large measure. Some other consortia may find it imperative to institutionalize their current programs due to reduced or eliminated external funding even if they may be at early stages. There may be consortia which are planning a major expansion to meet the mandate in the newer legislation to serve all students. Still others may terminate their Tech-Prep articulation agreements and shut down the programs.

- Those mathematics faculty in Tech-Prep or similar programs who make use of the detailed tables of mathematics topics, particularly Tables 6 through 14, as well as those who re-examine the number and timing of their math courses may decide to consider changes in their programs as a result of this report. To the extent that this happens, the report may be thought to have a useful impact.

The wide range of mathematics topics which are revealed in this study may be attributable to the nature of decision rules related to curriculum planning for career paths for associate degree graduates in business, allied health, engineering technology and industrial technology fields. Associate degree programs in some of these fields are governed by specialized accreditation requirements which influence many curriculum decisions. Other fields may be shown not to be math dependent and curricula for these

areas often place emphasis elsewhere in the curriculum and lessen the mathematics demand. Some Tech-Prep curriculum planners insist on the strongest mathematics content for their program espousing the view that everyone should take college preparatory mathematics, regardless of their occupational goals. It appears that all of these decision rules have operated to some extent in the Tech-Prep programs sampled in this study.

The New York State Education Department which promulgated the Framework statements in draft form for discussion may find the tables which deal with the Framework statements of some use in considering future editions of the "Framework for Mathematics, Science and Technology". The pertinent tables are Tables 19 through 26 and Table 27 in particular which shows several of the statements which appear to deviate from what the respondents felt were valid for their Tech-Prep math curricula. There were a few statements noted in Table 27 which indicated some uncertainty on the part of a cluster of respondents which may be sufficient cause to re-examine those statements.

The cooperative response which this study received from the Project Directors and the mathematics faculties across the state is an indication that Tech-Prep is important to these practitioners, and by extension to the students of New York State. Tech-Prep has typically generated significant enthusiasm from all concerned and has been responsible for a long list of innovative approaches to secondary and community college education. While this study has focused narrowly on mathematics courses and their content, one should be aware of the joint curriculum planning in all subject areas by secondary and post-secondary faculty working together -- itself an important innovation. These efforts involve visits by students, faculty and counselors to each other's institutions as well as a good deal of bridging into college courses by secondary students prior to their graduation. While the mathematics respondents seemed to indicate relatively little computer activity in math courses by students, there is extensive computer use throughout most of the Tech-Prep programs, most often in the communications, science and technology components.

TABLE 1

TECH-PREP MATHEMATICS CURRICULUM CATEGORY

CURRICULUM CATEGORY	NO. OF CURRICULA	PERCENT OF CURRICULA
A	16	59.3
B	5	18.5
C	2	7.5
D	4	14.8
TOTAL	27	100

A = Curricula with no Sequential Math Courses; All Math in Applied Courses

B = Curricula with Sequential Math Course I and other Applied Math

C = Curricula with Sequential Math Courses I & II and other Applied Math

D = Curricula with Sequential Math Courses I, II & III

TABLE 2A

CATEGORY A -- TECH-PREP CURRICULA WITH NO SEQUENTIAL COURSES (N = 16)
TOPICS IN SEQUENTIAL COURSES COVERED IN TECH-PREP MATHEMATICS CURRICULA BY SEQUENTIAL COURSE

SEQUENTIAL COURSE	No. TOPICS COVERED RANGE	MEDIAN	% MEDIAN*
I	21 -- 88	67.5	75.8
II	11 -- 76	38.5	33.8
III	2 -- 96	26	22.8
TOTAL	37 -- 251	130	41.0

* % MEDIAN = Median No. of Topics / Total No. of Topics in the Sequential Course

e.g. For Course I, % MEDIAN = 67.5 / 89 = .758 or 75.8%

TABLE 2B

CATEGORY B -- TECH-PREP CURRICULA WITH ONE SEQUENTIAL COURSE (N = 5)
TOPICS IN SEQUENTIAL COURSES COVERED IN TECH-PREP MATHEMATICS CURRICULA BY SEQUENTIAL COURSE

SEQUENTIAL COURSE	No. TOPICS COVERED RANGE	MEDIAN	% MEDIAN*
I	89	89	100
II	26 -- 88	60	52.6
III	24 -- 87	41	36.0
TOTAL	149 -- 264	190	59.9

* See Footnote to Table 2A

TABLE 2C

CATEGORY C -- TECH-PREP CURRICULA WITH TWO SEQUENTIAL COURSES (N = 2)
TOPICS IN SEQUENTIAL COURSES COVERED IN TECH-PREP MATHEMATICS CURRICULA BY SEQUENTIAL COURSE

SEQUENTIAL COURSE	No. COVERED MEDIAN	% MEDIAN*
I	89	100
II	114	100
III	78	68.4
TOTAL	280.5	88.5

* See Footnote to Table 2A

FIGURE 1

% MEDIAN NUMBER OF TOPICS FROM SEQUENTIAL MATH COURSES WHICH ARE COVERED IN TECH-PREP CURRICULA BY CATEGORY & SEQUENTIAL COURSE

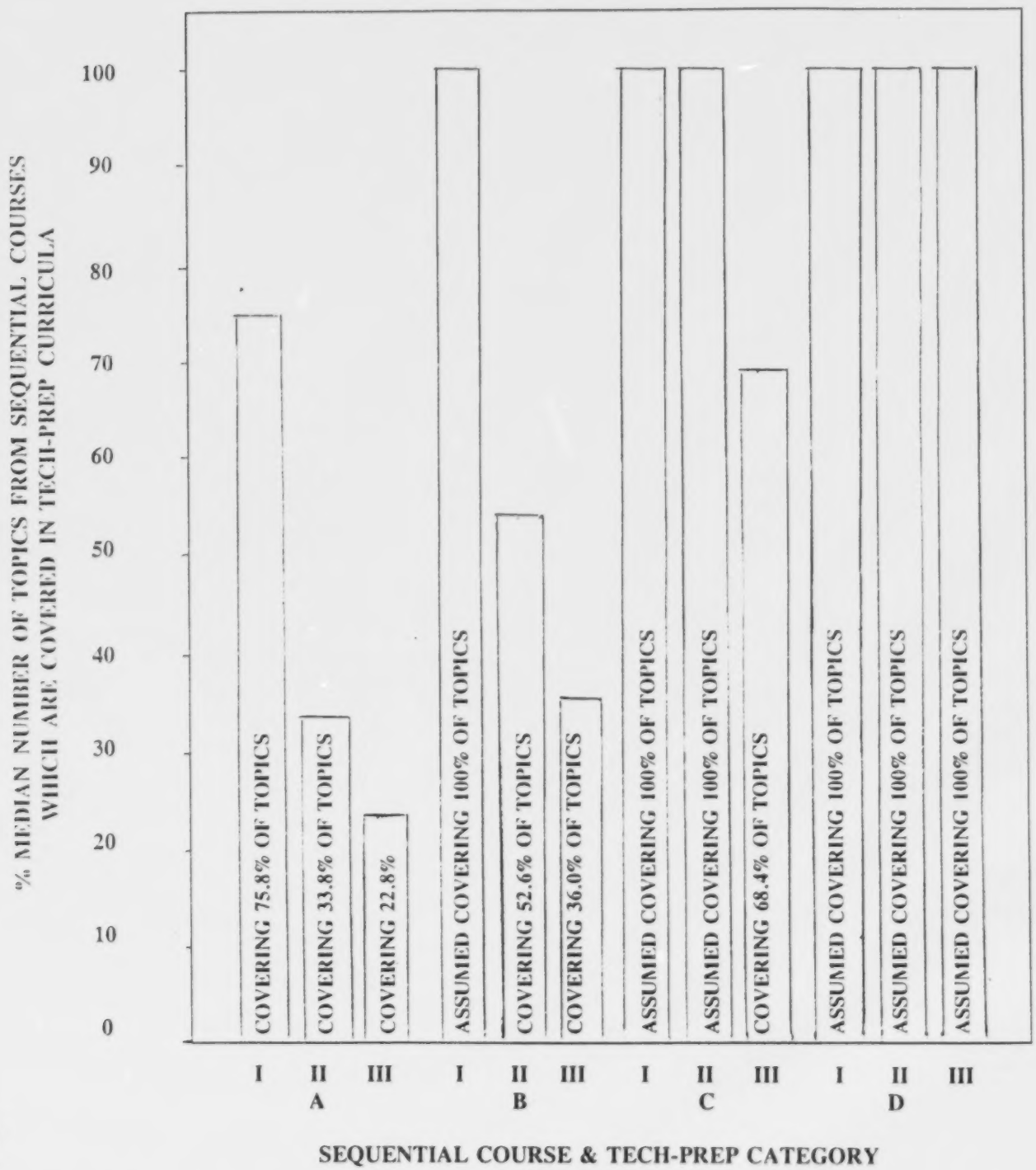

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TABLE 3

NUMBER OF TOPICS IN SEQUENTIAL MATH COURSES BY SUBJECT AREA

SUBJECT	NUMBER OF TOPICS SEQUENTIAL COURSE I	II	III	TOTAL	% of TOT	RANK
LOG	7	12	1	20	6.3	5.5
NUM	5	----	6	11	3.5	7
OPS	13	1	6	20	6.3	5.5
GEO	16	52	19	87	27.4	2
MEA	2	3	2	7	2.2	8
PRB	15	9	10	34	10.7	4
ALG	29	31	31	91	28.7	1
TRG	----	6	33	39	12.3	3
OTHER	2	----	6	8	2.5	----
TOTAL	89	114	114	317	100	

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTHER = Topics Not Included Above

RANK = Size Order of Number of Topics

TABLE 4

TOPICS IN SEQUENTIAL COURSES COVERED IN TECH-PREP MATHEMATICS CURRICULA BY SUBJECT AREA

			CATEGORY A (N = 16)				CATEGORY B (N = 5)				CATEGORY C (N = 2)		
	ALL TOPICS		TECH-PREP TOPICS				TECH-PREP TOPICS				TECH-PREP TOPICS		
SUBJECT	No.	RANK	RANGE	MEDIAN	RANK	% MDN	RANGE	MEDIAN	RANK	% MDN	MEDIAN	RANK	% MDN
LOG	20	5.5	0 -- 16	2.5	8	12.5	7 -- 18	9	6	45.0	19	5.5	95.0
NUM	11	7	1 -- 10	7	6	63.6	6 -- 11	6	7.5	54.5	10	7	90.9
OPS	20	5.5	5 -- 20	11	5	55.0	13 -- 19	14	5	70.0	19	5.5	95.0
GEO	87	2	13 -- 62	30.5	2	35.1	24 -- 74	50	2	57.5	75.5	2	86.8
MEA	7	8	2 -- 7	6	7	85.7	4 -- 7	6	7.5	85.7	6	8	85.7
PRB	34	4	0 -- 34	17	3	50.0	15 -- 32	22	3	64.7	32.5	3	95.6
ALG	91	1	7 -- 82	39.5	1	43.4	49 -- 80	68	1	74.7	87	1	95.6
TRG	39	3	0 -- 36	13.5	4	34.6	0 -- 32	15	4	38.5	29.5	4	75.6
OTHER	8	----	0 -- 7	1	----	12.5	2	2	----	25.0	2	----	25.0
TOTAL	317		37 -- 251	130		41.0	149 -- 264	190		59.9	280.5		88.5

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTHER = Topics Not Included Above

RANGE = Minimum & Maximum No. of Topics Covered in Tech-Prep Curricula of All Sequential Course Topics in a Subject Area

% MDN = Median of the % Coverage in Tech-Prep Curricula of All Sequential Course Topics in a Subject Area

RANK = Size Order of Median No. of Topics

TABLE 5A

CATEGORY A -- TECH-PREP CURRICULA WITH NO SEQUENTIAL COURSES
(N = 16)
TIME DEVOTED TO TOPICS FROM SEQUENTIAL MATH COURSES IN TECH-PREP MATHEMATICS CURRICULA BY SUBJECT AREA & SEQUENTIAL COURSE

	SEQUENTIAL I			SEQUENTIAL II			SEQUENTIAL III			TOTAL			
		HOURS			HOURS			HOURS			HOURS		
SUBJECT	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	% TP MEDN
LOG	7	8.0	12.3	11	13.5	16.6	----	----	----	18	21.5	28.9	134.4
NUM	5	2.8	6.3	----	----	----	6	4.8	8.8	11	7.5	15.0	200.0
OPS	13	7.8	15.6	1	1.0	0.8	6	4.0	5.6	20	12.8	21.9	171.1
GEO	16	25.3	23.0	43	34.5	51.8	17	17.0	18.0	66	76.8	92.8	120.8
MEA	2	2.5	5.3	3	3.5	5.3	2	2.5	4.0	7	8.5	14.5	170.6
PRB	15	22.5	23.4	9	13.5	10.6	10	15.0	12.1	34	51.0	46.1	90.4
ALG	29	44.0	47.9	27	29.8	40.9	31	32.0	36.7	87	105.8	125.5	118.6
TRG	----	----	----	6	5.0	8.9	33	34.5	43.5	39	39.5	52.3	132.4
OTH	1	3.0	8.3	----	----	----	6	5.3	5.1	7	8.3	13.4	161.4
TOTAL	88	115.9	142.1	100	100.8	134.9	111	115.1	133.8	289	331.7	410.4	123.7

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTHER = Topics Not Included Above

No. TP TOPCS = Number of Sequential Course Topics Which are Covered in One or More Tech-Prep Curricula in a Subject Area by Course
STAND = Standard Hours Needed to Cover Topics in No. TP TOPCS in a Subject Area
TP MEDN = Median Hours in Tech-Prep Curricula to Cover Subject Topics in No. TP TOPCS
% TP MEDN = Percentage Which TP MEDN Hours is of STAND Hours in a Subject Area

TABLE 5B

CATEGORY B -- TECH-PREP CURRICULA WITH ONE SEQUENTIAL COURSE
(N = 5)
TIME DEVOTED TO TOPICS FROM SEQUENTIAL MATH COURSES IN TECH-PREP MATHEMATICS CURRICULA BY SUBJECT AREA & SEQUENTIAL COURSE

	SEQUENTIAL I			SEQUENTIAL II			SEQUENTIAL III			TOTAL			
		HOURS			HOURS			HOURS			HOURS		
SUBJECT	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	No. TP TOPCS	STAND	TP MEDN	% TP MEDN
LOG	7	8.0	8.0	11	15.5	23.0	----	----	----	18	23.5	31.0	131.9
NUM	5	2.8	2.8	----	----	----	6	4.8	5.5	11	7.5	8.3	110.7
OPS	13	7.8	7.8	1	1.0	0.8	6	4.0	4.4	20	12.8	12.9	100.8
GEO	16	25.3	25.3	49	44.5	62.5	11	11.0	6.7	76	80.8	94.5	117.0
MEA	2	2.5	2.5	3	3.5	3.8	2	2.5	2.0	7	8.5	8.3	97.6
PRB	15	22.5	22.5	9	12.5	11.1	9	13.0	20.4	33	48.0	54.0	112.5
ALG	29	44.3	44.3	25	27.8	27.2	31	32.5	35.6	85	104.6	107.1	102.4
TRG	----	----	-----	6	5.0	7.5	31	33.0	38.0	37	38.0	45.5	119.7
OTH	2	7.0	7.0	----	----	----	----	----	----	2	7.0	7.0	100.0
TOTAL	89	120.2	120.2	104	109.8	135.9	96	100.8	112.6	289	330.7	368.6	111.5

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTHER = Topics Not Included Above

No. TP TOPCS = Number of Sequential Course Topics Which are Covered in One or More Tech-Prep Curricula in a Subject Area by Course
STAND = Standard Hours Needed to Cover Topics in No. TP TOPCS in a Subject Area
TP MEDN = Median Hours in Tech-Prep Curricula to Cover Subject Topics in No. TP TOPCS
% TP MEDN = Percentage Which TP MEDN Hours is of STAND Hours in a Subject Area

TABLE 5C

CATEGORY C -- TECH-PREP CURRICULA WITH TWO SEQUENTIAL COURSES
(N = 2)
TIME DEVOTED TO TOPICS FROM SEQUENTIAL MATH COURSES IN TECH-PREP MATHEMATICS CURRICULA BY SUBJECT AREA

		TOTAL HOURS		
SUBJECT	No. TP TOPCS	STAND	TP MEDN	% TP MEDN
LOG	19	24.5	24.5	100.0
NUM	11	7.5	14.1	188.0
OPS	20	12.8	15.1	118.0
GEO	82	83.3	86.7	104.1
MEA	6	7.5	7.5	100.0
PRB	34	50.0	54.0	108.0
ALG	90	109.8	112.8	102.7
TRG	37	36.0	57.0	158.3
OTH	2	7.0	7.0	100.0
TOTAL	301	338.4	378.7	111.9

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTHER = Topics Not Included Above

No. TP TOPCS = Number of All Sequential Course Topics Which are Covered in One or More Tech- Prep Curricula in a Subject Area
STAND = Standard Hours Needed to Cover All Topics in No. TP TOPCS in a Subject Area
TP MEDN = Median Hours in Tech-Prep Curricula to Cover Subject Topics in No. TP TOPCS
% TP MEDN = Percentage Which TP MEDN Hours is of STAD Hours in a Subject Area

FIGURE 2

% MEDIAN TIME USED FOR TOPICS IN TECH-PREP CURRICULA COMPARED TO SEQUENTIAL MATH COURSE "STANDARD" TIME BY CATEGORY & SEQUENTIAL COURSE

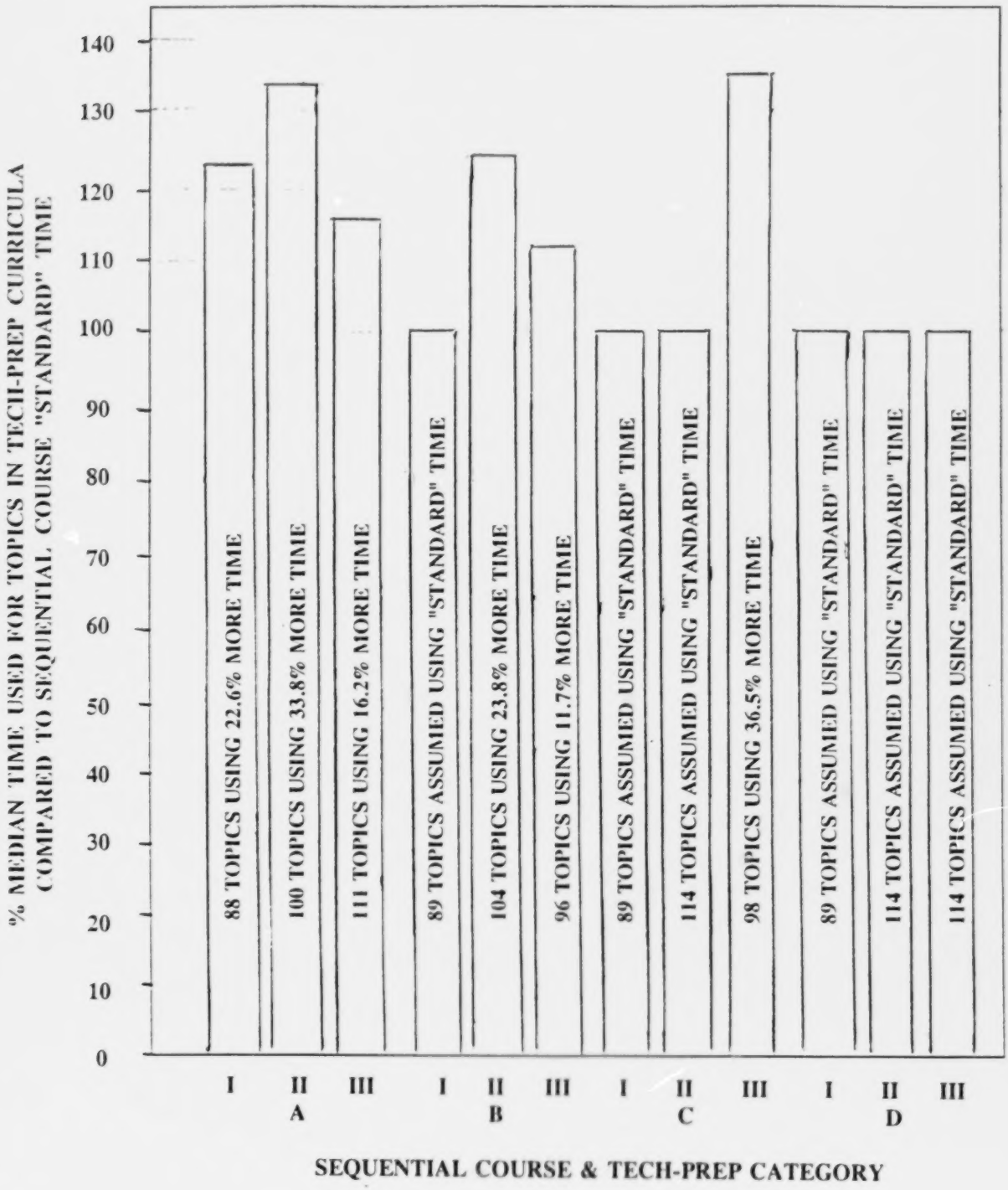
% MEDIAN TIME USED FOR TOPICS IN TECH-PREP CURRICULA COMPARED TO SEQUENTIAL COURSE "STANDARD" TIME
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
88 TOPICS USING 22.6% MORE TIME
100 TOPICS USING 33.8% MORE TIME
111 TOPICS USING 16.2% MORE TIME
89 TOPICS ASSUMED USING "STANDARD" TIME
104 TOPICS USING 23.8% MORE TIME
96 TOPICS USING 11.7% MORE TIME
89 TOPICS ASSUMED USING "STANDARD" TIME
114 TOPICS ASSUMED USING "STANDARD" TIME
98 TOPICS USING 36.5% MORE TIME
89 TOPICS ASSUMED USING "STANDARD" TIME
114 TOPICS ASSUMED USING "STANDARD" TIME
114 TOPICS ASSUMED USING "STANDARD" TIME
I II A III I II B III I II C III I II D III
SEQUENTIAL COURSE & TECH-PREP CATEGORY

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TABLE 6

LOGIC TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	2	Sentences, Statements & Open Sentences	12	75.0	0.50	0.75 -- 3.00	2.00
	3	Introduction to Truth Tables: Negation & Conjunction	8	50.0	0.50	0.50 -- 4.00	2.50
	4	Conjunction & Disjunction	7	43.8	1.00	1.00 -- 4.00	2.50
	5	Application of Logic to Mathematical Sentences	5	31.3	0.50	2.00 -- 4.00	2.00
	8	Sets & Logic	7	43.8	0.50	0.50 -- 2.00	0.75
	55	Symbolic Logic Related to Conditional Statements	4	25.0	3.00	1.00 -- 1.50	1.25
	56	Conditional Statements -- Inverse, Converse, Contrapositive	4	25.0	2.00	1.00 -- 1.50	1.25
II	90	Rules for Connectives	6	37.5	1.00	1.50 -- 4.00	1.75
	91	Laws of Logic	4	25.0	1.00	1.50	1.50
	92	Apply Laws of Logic to Test Validity of an Argument	4	25.0	1.00	1.50	1.50
	93	Laws of Syllogism & Disjunctive Inference	4	25.0	1.00	1.50	1.50
	94	Negate Conjunctions & Disjunctions	5	31.3	1.00	1.00 -- 1.50	1.50
	95	Use Laws of Logic to Write More Complicated Proofs	3	18.8	2.00	1.50	1.50
	96	Role of Quantifiers	2	12.5	1.00	1.00	1.00
	97	Foundations of an Axiomatic System	2	12.5	1.00	2.00	2.00
	98	Undefined & Defined Terms Concerning Lines	6	37.5	0.50	0.50 -- 2.00	1.38
	109	Formal Proof	0	0.0	3.00	----	----
	161	Proving Geometric Relationships with Coordinate Geometry	1	6.3	2.00	1.50	1.50
	162	Proving General Theorems with Coordinate Geometry	1	6.3	2.00	1.50	1.50
III	317	Principle of Mathematical Induction	0	0.0	2.00	----	----
		TOTALS	85		26.50		28.88

TABLE 7

NUMBER SENSE & NUMERATION CONCEPTS TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	1	Numbers & Their Names	12	75.0	0.50	0.20 -- 5.00	2.00
	9	Introduction to Real Numbers	15	93.8	0.50	0.20 -- 3.00	1.25
	35	Introduction to Square Roots	15	93.8	0.25	0.50 -- 4.00	1.00
	36	Estimating Irrational Square Roots	11	68.8	1.00	0.20 -- 2.00	1.00
	74	Ordered Pairs in a Coordinate Plane	14	87.5	0.50	0.50 -- 2.00	1.00
III	204	Extending the Number System	8	50.0	1.00	0.50 -- 4.00	1.00
	205	Properties of Real Numbers	10	62.5	1.00	0.75 -- 5.00	1.00
	223	Imaginary Numbers	4	25.0	0.50	0.60 -- 3.00	1.75
	224	Properties of Complex Numbers	4	25.0	0.75	0.60 -- 3.00	1.50
	268	Evaluating Expressions Involving Rational Exponents	7	43.8	1.00	0.50 -- 4.00	1.75
	269	Using Scientific Notation to Write Numbers	14	87.5	0.50	0.50 -- 5.75	2.00
		TOTALS	114		7.5		15.25

TABLE 8

OPERATIONS ON NUMBER TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	10	Addition of Real Numbers	15	93.8	0.25	0.20 -- 3.00	1.13
	11	Subtraction of Real Numbers	15	93.8	0.25	0.20 -- 3.00	1.13
	12	Identity Elements & Inverses	12	75.0	0.50	0.10 -- 2.00	0.75
	13	Assciatve Addition, Distrbutve Multiplication, Order of Opers	15	93.8	1.00	0.50 -- 5.00	1.75
	14	Multiplication of Real Numbers	15	93.8	0.25	0.20 -- 3.00	1.25
	15	Associativity	12	75.0	0.50	0.20 -- 2.00	0.75
	16	Commutativity	13	81.3	0.50	0.20 -- 2.00	0.75
	17	Applications of the Laws of Algebra	15	93.8	0.50	0.20 -- 5.00	1.63
	21	Division of Real Numbers	15	93.8	0.50	0.20 -- 5.00	1.50
	22	Laws of Exponents	15	93.8	0.50	0.60 -- 5.00	1.50
	37	Multiplying Radicals (Involving Square Roots Only)	8	50.0	0.50	0.50 -- 2.00	1.00
	38	Simplifying Radicals	9	56.3	1.00	0.50 -- 2.00	1.50
	39	Adding & Subtracting Radicals	9	56.3	1.50	0.50 -- 2.00	1.00
II	192	Linear & Circular Seating Problems	4	25.0	1.00	0.60 -- 1.00	0.75
III	225	Dividing Complex Numbers	3	18.8	0.50	1.20 -- 2.00	1.50
	273	Finding the Logarithm of a Number	4	25.0	1.00	0.60 -- 2.50	1.50
	274	Using Common Logarithm Tables	3	18.8	1.00	0.60 -- 2.00	0.75
	275	Finding the Logarithm of a Product	3	18.8	0.50	0.50 -- 0.75	0.60
	276	Finding the Logarithm of a Quotient	3	18.8	0.50	0.50 -- 0.75	0.60
	277	Finding the Logarithm of a Power or Root	3	18.8	0.50	0.50 -- 0.75	0.60
		TOTALS	191		12.75		20.83

TABLE 9

GEOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
I	50	Identification of Plane Figures	11	68.8	0.50	0.60 -- 3.00	1.00
	51	Symmetry in a Plane	7	43.8	1.00	0.75 -- 2.00	1.50
	52	Introduction to Transformations & Congruence	7	43.8	0.25	0.75 -- 5.00	1.50
	53	Identifying Translations, Reflections, Rotations & Properties	6	37.5	2.00	0.75 -- 1.00	0.88
	54	Identifying Dilations & Working with Ratios & Proportions	9	56.3	2.00	0.75 - 10.00	1.50
	57	Methods of Determining Congruent Triangles	4	25.0	3.00	0.60 --1.50	0.75
	58	Angle Relationships: Supplementary, Complementary, Vertcl	13	81.3	1.50	0.75 -- 4.00	2.00
	59	Classifying Triangles by Side Lengths & Angle Measures	13	81.3	1.50	0.50 -- 3.25	1.50
	60	The Pythagorean Theorem	16	100	3.00	0.75 --6.00	2.25
	61	Circles	16	100	1.50	0.50 -- 5.00	2.25
	62	Relations of Straight Lines in a Plane: Parallel vs. Intersecting	14	87.5	0.50	0.25 -- 5.00	1.50
	63	Making Inferences About Given Parallel Lines	14	87.5	2.50	0.50 -- 4.00	2.00
	64	Exploring Relationships Among Interior Angles of a Polygon	7	43.8	1.50	0.50 -- 1.50	0.88
	65	Classification of Quadrilaterals Based on Parallelism of Sides	12	75.0	1.50	0.50 --2.00	1.00
	66	Making Inferences About Special Parallelograms	11	68.8	2.00	0.25 -- 2.00	1.00
	73	Review of Analytic Geometry	12	75.0	1.00	0.60 -- 2.00	1.50
II	99	Basic Terminology of Angles & Angle Measurement	14	87.5	0.50	0.50 -- 5.00	1.75
	100	Different Types of Angles Pairs	12	75.0	0.50	0.50 -- 3.00	1.00
	101	Special Line Segments Associated with a Triangle	10	62.5	0.75	0.25 -- 2.00	1.00
	102	Construct Special Line Segments Associated with a Triangle	7	43.8	1.25	0.50 -- 1.00	0.75
	106	Congruent Angles	12	75.0	0.50	0.25 -- 3.00	1.00
	107	Perpendicular Lines & Altitudes	14	87.5	0.50	0.60 -- 3.00	1.50
	108	Bisectors & Midpoints	12	75.0	1.00	0.60 -- 2.00	1.25

(Continued)

TABLE 9 (Continued)

GEOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
II	110	Congruent Polygons	3	18.8	0.50	1.50	1.50
	111	Side-Angle-Side Proofs	1	6.3	1.50	1.50	1.50
	112	Angle-Side-Angle & Side-Side-Side	1	6.3	1.50	----	----
	113	More Difficult Congruent Triangles	0	0.0	1.00	----	----
	114	Corresponding Parts of Congruent Triangles	1	6.3	1.00	1.50	1.50
	115	Isosceles Triangles	12	75.0	0.50	0.25 -- 2.00	1.00
	116	Equilateral Triangles	11	68.8	0.50	0.25 -- 2.00	1.00
	117	Prove Overlapping Triangles are Congruent	0	0.0	2.00	----	----
	118	More Difficult Overlapping Triangle Proofs	0	0.0	1.50	----	----
	119	Using Two Pair of Congruent Triangles in a Proof	0	0.0	2.00	----	----
	120	Perpendicular Lines	13	81.3	0.50	0.30 -- 4.00	1.50
	121	Parallel Lines	13	91.3	0.50	0.30 -- 4.00	1.50
	122	Prove That Lines are Parallel	2	12.5	1.00	1.50	1.50
	123	Properties of Parallel Lines	9	56.3	1.00	0.30 -- 2.00	1.50
	124	Sum of the Measures of the Angles of a Triangle	16	100	1.00	0.25 -- 3.00	1.00
	125	Prove Triangle Congruent	2	12.5	0.50	2.00	2.00
	126	Converse of Isosceles Triangle Theorem	3	18.8	0.50	1.50 -- 2.00	1.75
	127	Prove Right Triangles are Congruent	1	6.3	0.50	1.50	1.50
	128	Relating Exterior to Non-Adjacent Interior Angles	6	37.5	0.50	0.60 -- 1.50	0.75
	129	Formulas Concerning Interior Angles	4	25.0	0.50	0.60 -- 1.25	0.75
	130	Formulas Concerning Exterior Angles	4	25.0	0.50	0.60 -- 1.00	0.75
	131	Properties of a Parallelogram	12	75.0	1.00	0.25 -- 2.00	1.00

(Continued)

TABLE 9 (Continued)

GEOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
II	132	Prove That a Quadrilateral is a Parallelogram	1	6.3	1.50	0.75	0.75
	133	Prove That a Quadrilateral is a Rectangle	1	6.3	1.00	0.75	0.75
	134	Prove That a Quadrilateral is a Rhombus	1	6.3	0.50	0.75	0.75
	135	Prove That a Quadrilateral is a Square	1	6.3	0.50	0.75	0.75
	136	Prove That a Quadrilateral is an Isosceles Trapezoid	1	6.3	0.50	0.75	0.75
	137	Ratios & Proportions	14	87.5	2.00	1.50 - 10.00	5.00
	138	Proportion Associated with a Triangle	9	56.3	1.00	0.50 -- 5.00	1.50
	139	Prove That Triangles are Similar	3	18.8	1.50	0.25 -- 2.00	0.75
	140	Prove That Line Segments are in Proportion	1	6.3	1.50	0.25	0.25
	141	Prove That Products of Line Segments are Equal	0	0.0	1.50	----	----
	142	Special Proportions of Line Segments in Similar Polygons	5	31.3	0.50	0.60 -- 1.50	0.88
	143	Proportions in the Right Triangle	9	56.3	1.50	0.60 -- 3.00	1.50
	144	Apply the Pythagorean Theorem	15	93.8	1.00	0.50 -- 5.00	2.00
	145	30°-60°-90° Triangle	12	75.0	1.50	0.60 -- 2.00	1.25
	146	45°-45°-90° Triangle	12	75.0	0.50	0.50 -- 2.00	1.13
	153	Rectangular Coordinate System	11	68.8	0.50	0.50 -- 3.00	1.25
	155	The Midpoint Formula	10	62.5	1.00	0.25 -- 3.00	1.50
	157	Slopes of Parallel & Perpendicular Lines	12	75.0	1.00	0.50 -- 3.00	1.00
	165	Five Basic Loci	0	0.0	0.50	----	----
	166	Geometric Applications of Locus	0	0.0	1.00	----	----
	167	Finding a Locus by Construction	0	0.0	1.00	----	----
	168	Intersection of Loci	0	0.0	1.00	----	----
	171	Locus of Points Equidistant from Three Non-collinear Points	1	6.3	0.50	----	----

(Continued)

TABLE 9 (Continued)

GEOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
III	235	Transformational Geometry	4	25.0	1.00	1.50	1.50
	236	Properties of Line Reflections Using Coordinate Geometry	5	31.3	1.00	0.50 -- 1.50	0.75
	237	Point Reflection & Point Symmetry	5	31.3	1.00	0.50 -- 1.50	0.75
	238	Translation	5	31.3	1.00	0.50 -- 1.50	0.75
	239	Rotation	5	31.3	1.00	0.50 -- 1.50	0.75
	240	Dilation	6	37.5	1.00	0.50 -- 2.00	1.13
	241	Parts of a Circle	13	81.3	0.50	0.50 -- 4.00	1.00
	242	Proving Arcs & Chords Congruent	1	6.3	0.50	1.00	1.00
	243	Proving Chords Congruent	0	0.0	0.50	----	----
	244	Measuring Inscribed Angles	5	31.3	1.00	1.00 -- 3.00	1.00
	245	Tangents to a Circle	5	31.3	1.00	0.60 -- 3.00	2.00
	246	Measuring Angles: Tangent-Chord, 2 Tangents, 2 Secants...	3	18.8	1.50	0.60 -- 3.00	0.75
	247	Measuring an Angle Formed by Two Chords	3	18.8	1.00	0.50 -- 0.75	0.60
	250	Constructions Related to the Circle	4	25.0	1.00	0.60 -- 2.00	0.75
	306	Composition of Transformations	3	18.8	1.50	1.50	1.50
	307	Geometric Transformations with Mathematical Systems	0	0.0	2.00	----	----
	308	Glide Reflection	1	6.3	1.00	0.75	0.75
	309	Isometrics	2	12.5	1.00	1.50	1.50
	310	Similarity Transformations	1	6.3	1.00	1.50	1.50
		TOTALS	557		92.75		92.98

TABLE 10

MEASUREMENT TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
I	67	Finding Areas of Polygonal Regions	15	93.8	2.00	0.50 -- 5.00	2.00
	88	Volume	15	93.8	0.50	0.50 -- 5.00	3.25
II	154	The Distance Formula	11	68.8	1.50	0.25 -- 3.00	1.50
	156	The Slope Formula	13	81.3	1.00	0.50 -- 4.00	1.75
	164	Finding Areas by Using Rectangles & Trapezoids	11	68.8	1.00	1.20 -- 6.50	2.00
III	248	Finding the Length of Line Segments	9	56.3	1.00	0.25 -- 6.75	2.00
	249	Circular Circumference, Area, Arc Length, Sector, Segment	9	56.3	1.50	0.60 -- 5.00	2.00
		TOTALS	83		8.50		14.50

TABLE 11

PROBABILITY & STATISTICS TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	24	What is Probability?	13	81.3	1.50	0.60 -- 3.00	1.25
	25	Why do we Introduce Sample Space?	12	75.0	0.50	0.60 -- 5.00	1.00
	26	What are the Relationships Between Logic & Probability?	4	25.0	0.50	0.25 -- 0.60	0.43
	27	How do we Apply Probability to Real Life Situations?	12	75.0	2.00	0.60 -- 8.00	3.00
	46	The Fundamental Counting Principle	10	62.5	1.50	0.50 -- 2.00	1.00
	47	Permutations	8	50.0	1.50	0.25 -- 4.00	1.00
	48	Factorials	6	37.5	0.50	0.50 -- 1.50	1.00
	49	Multistage Probability Problems	6	37.5	3.00	0.50 -- 1.80	1.00
	68	Introduction to Statistics	13	81.3	0.50	0.60 -- 3.00	2.00
	69	Data Tables	15	93.8	2.50	0.60 - 20.00	1.75
	70	Graphs & Histograms	14	87.5	3.00	1.00 -- 7.00	2.00
	71	Measures of Central Tendency	14	87.5	2.50	0.60 - 12.00	2.00
	72	Grouped Data	13	81.3	0.50	0.50 -- 8.00	2.00
	86	Cumulative Frequency Histograms	7	43.8	1.00	1.20 -- 3.75	2.00
	87	Measures of Position: Median, Quartiles, Percentiles	9	56.3	1.50	0.60 -- 3.50	2.00
II	188	Simple Probability Problems	12	75.0	2.00	0.50 -- 3.00	2.00
	189	Permutations	8	50.0	1.00	0.60 -- 1.50	1.00
	190	Permutations with Repetitions	3	18.8	1.50	0.60 -- 1.50	1.05
	191	Using Permutations to Solve Word & Numerical Problems	5	31.3	2.00	0.60 -- 3.00	1.25
	193	Combinations	5	31.3	1.00	0.60 -- 1.50	1.25
	194	Applying Combinations to Counting	4	25.0	1.00	0.60 -- 1.50	1.00
	195	Applying Combinations to Geometry	3	18.8	1.00	0.60 -- 1.50	1.05
	196	Using Combinations to Solve Probability Problems	4	25.0	2.00	0.60 -- 1.00	1.00
	197	More Difficult Problems in Counting & Probability	4	25.0	1.00	0.60 -- 2.00	1.00

(Continued)

TABLE 11 (Continued)

PROBABILITY & STATISTICS TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
III	296	Tree Diagrams for Probabilities in 2+ Stage Experiments	4	25.0	1.00	0.60 -- 2.00	1.25
	297	Solving Conditional Probability Problems	4	25.0	2.00	0.60 -- 0.75	0.75
	298	Probability of an Event in Sequence of Independent Trials	4	25.0	1.00	0.60 -- 0.75	0.75
	299	Using the Binomial Theorem to Solve Probability Problems	3	18.8	2.00	0.60 -- 1.50	1.50
	300	Data from Experiments to Determine & Verify Probabilities	4	25.0	2,50	0.60 -- 3.00	1.13
	301	Using Summation Notation	3	18.8	1.00	0.60 -- 2.50	1.55
	302	Using Frequency Tables to Organize Data & Find the Mean	10	62.5	1.00	0.60 - 12.00	1.50
	303	Finding Measures of Central Tendency	13	81.3	1.50	0.25 -- 8.00	1.38
	304	Finding Measures of Dispersion	12	75.0	1.00	0.50 -- 6.00	1.50
	305	Probabilities of an Experiment Having a Normal Distribution	9	56.3	2.00	0.50 -- 2.50	0.75
		TOTALS	270		48.50		44.83

TABLE 12

ALGEBRA TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	6	Logic, Graphs & Solution Sets	4	25.0	0.50	0.50 -- 2.00	1.25
	7	Using Logic to Help Solve Inequalities	4	25.0	1.00	0.20 -- 0.50	1.25
	19	Expressing Relationships with Variables & Open Sentences	16	100	3.00	0.50 - 20.00	2.00
	20	Monomials	16	100	0.50	0.60 -- 4.00	1.25
	23	Multiplication & Division of Monomials	13	81.3	0.50	0.50 -- 5.00	1.50
	28	Compare/Contrast Addition & Multiplication of Monomials	11	68.8	0.50	0.25 -- 3.00	1.50
	29	Multiplication & Division of Monomial Term Algbr Fractions	9	56.3	1.50	0.60 -- 3.00	1.50
	30	Solution of Linear Equations Involving One Operation	15	93.8	1.00	0.60 -- 8.00	2.50
	31	Solution of Linear Equations Involving Two Operations	15	93.8	2.50	1.00 -- 8.00	4.25
	32	Solving Linear Inequalities Involving One Operation	12	75.0	0.50	0.50 -- 6.00	2.00
	33	Adding & Subtracting Polynomials	12	75.0	1.25	0.50 -- 4.00	1.50
	34	Multiplying a Polynomial by a Monomial	12	75.0	1.00	0.25 -- 4.00	1.25
	40	Introduction to Quadratic Equations	14	87.5	0.50	0.50 -- 3.00	1.00
	41	Solving Quadratic Equations in Form of a Product = 0	12	75.0	0.50	0.50 -- 3.00	1.50
	42	Introduction to Factoring	12	75.0	1.00	0.50 -- 4.00	2.00
	43	Multiplying Binomials	14	87.5	1.50	0.50 -- 3.00	1.50
	44	Solving Quadratic Equations by Factoring	11	68.8	3.00	0.50 -- 3.00	1.75
	45	Verbal Problems Leading to Quadratic Equations	12	75.0	1.50	0.50 -- 5.00	2.00
	75	Slope of a Straight Line	15	93.8	1.50	0.60 -- 5.00	1.75
	76	Equation of a Straight Line	15	93.8	2.00	0.50 -- 5.00	2.00
	77	Graphing a Linear Equation	14	87.5	2.00	0.60 -- 8.00	2.00
	78	Graphic Solution of a System of Two Linear Equations	12	75.0	4.00	0.50 -- 4.00	1.75
	79	Graphing a Linear Inequality	12	75.0	1.00	0.50 -- 4.00	2.00

(Continued)

TABLE 12 (Continued)

ALGEBRA TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
I	80	Graphic Solution of a System of Linear Inequalities	13	81.3	2.00	0.50 -- 4.00	1.60
	81	Algebraic Solution of a System of Linear Equations	12	75.0	3.00	1.20 -- 6.00	2.00
	82	Reduction of Algebraic Fractions	6	37.5	1.50	0.50 -- 3.00	0.68
	83	Multiplication & Division of Algebraic Fractions	5	31.3	1.50	0.60 -- 3.00	1.13
	84	Addition & Subtraction of Algebraic Fractions	5	31.3	2.00	0.60 -- 3.00	1.13
	85	Applications of Algebraic Fractions, Equations, Inequalities	7	43.8	2.00	0.60 -- 6.00	1.38
II	103	Equivalence Relation	7	43.8	1.00	0.50 -- 4.00	1.25
	104	Addition & Reflexive Properties	4	25.0	0.50	0.50 -- 1.50	0.75
	105	Subtraction Property	4	25.0	0.50	0.75 -- 1.50	1.50
	158	Graphing a Linear Function	13	81.3	1.50	0.60 -- 5.00	1.75
	159	Point-Slope Form of the Equation of a Line	9	56.3	1.00	0.60 -- 3.00	1.50
	160	Slope-Intercept Form of the Equation of a Line	13	81.3	1.00	0.60 -- 5.00	1.75
	163	Area in Coordinate Geometry	7	43.8	2.00	0.60 -- 2.00	1.50
	169	Equation of a Locus	1	6.3	1.00	3.00	3.00
	170	Equation of a Circle	6	37.5	0.50	0.60 -- 1.50	1.00
	172	Finding Equations of Locus in the Coordinate Plane	3	18.8	1.00	1.20 -- 2.00	1.60
	173	The Equation of a Parabola	8	50.0	1.00	1.20 -- 5.00	2.00
	174	Intersection of Loci in the Coordinate Plane	1	6.3	1.00	2.50	2.50
	175	Solving Quadratic Equations by Factoring	10	62.5	2.00	1.20 -- 5.00	1.50
	176	Solving Quadratic Equations--Incomplete or Perfect Squares	7	43.8	0.50	1.00 -- 2.00	1.60
	177	Solving Quadratic Equations -- Leading Coefficient Isn't = 1	8	50.0	1.00	1.00 -- 1.50	1.20
	178	Graphing Quadratic Relations	8	50.0	1.00	0.60 -- 8.00	1.25
	179	Solving Quadratic Equations by Graphing	10	62.5	2.00	0.50 -- 1.50	1.00

(Continued)

TABLE 12 (Continued)

ALGEBRA TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
II	180	Completing the Square	4	25.0	0.50	0.75 -- 1.20	1.00
	181	Deriving the Quadratic Formula	4	25.0	1.50	0.60 -- 1.00	0.75
	182	Nature of the Roots of a Quadratic Equation	4	25.0	1.00	0.60 -- 0.75	0.68
	183	Relation Between Coefficients & Roots of Quadratic Equation	4	25.0	0.75	0.60 -- 0.75	0.68
	184	Finding Points of Intersection of a Parabola & a Line	3	18.8	1.00	1.50	1.50
	185	Solving Other Quadratic-Linear Systems Graphically	4	25.0	1.50	1.50 -- 2.50	2.00
	186	Solving Quadratic-Linear Systems Algebraically	4	25.0	1.50	1.50 -- 2.50	2.00
	187	Word Problems Which Lead to Quadratic Equations	13	81.3	1.50	0.50 -- 5.00	2.15
	198	Identity, Inverse & Closure	2	12.5	1.00	1.00 -- 2.00	1.50
	199	Commutative, Associative & Distributive Properties	6	37.5	1.00	0.60 -- 3.00	2.00
	200	Clock Arithmetic	0	0.0	1.00	----	----
	201	Definition of a Group	0	0.0	1.00	----	----
	202	Groups in Mathematical Systems	0	0.0	0.75	----	----
	203	Definition of a Field	0	0.0	1.00	----	----
III	206	Solving First Degree Equations	13	81.3	0.50	0.60 -- 5.00	2.00
	207	Solving Verbal Problems	14	87.5	2.00	0.50 -- 6.50	2.00
	208	Solving Linear Inequalities	9	56.3	1.00	0.60 -- 2.00	1.00
	209	Solving Compound Inequalities	6	37.5	0.50	0.50 -- 2.50	1.13
	210	Solving Absolute Value Equations	5	31.3	1.00	0.60 -- 1.00	0.88
	211	Solving Absolute Value Inequalities	4	25.0	1.00	0.50 -- 2.00	0.68
	212	Addition, Subtraction & Multiplication of Polynomial Terms	8	50.0	0.50	0.50 -- 5.00	1.75
	213	Factoring Polynomials	8	50.0	1.00	0.60 -- 3.00	1.00
	214	Division of Polynomials	7	43.8	1.00	0.60 -- 2.00	0.75

(Continued)

TABLE 12 (Continued)

ALGEBRA TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
III	215	Multiplying & Dividing Rational Expressions	8	50.0	0.50	0.60 -- 1.50	1.50
	216	Adding & Subtracting Rational Expressions	8	50.0	1.00	0.60 -- 1.50	1.50
	217	Simplifying Complex Fractions	4	25.0	1.00	0.60 -- 1.50	0.75
	218	Solving Fractional Equations	4	25.0	1.00	0.75 -- 2.00	1.50
	219	Solving Quadratic Inequalities by Factoring	6	37.5	1.00	0.50 -- 2.00	0.75
	220	Simplifying Radical Expressions	6	37.5	0.50	0.60 -- 3.00	1.00
	221	Multiplying & Dividing Radical Expressions	6	37.5	1.00	0.50 -- 3.00	1.00
	222	Solving Radical Equations	7	43.8	1.00	0.60 -- 2.00	1.00
	226	Nature of the Roots of a Quadratic Equation	4	25.0	1.00	0.25 -- 1.50	0.80
	227	Sum & Product of the Roots of a Quadratic Equation	3	18.8	1.00	0.60 -- 1.50	1.00
	228	Relations	7	43.8	1.00	0.50 -- 1.50	1.00
	229	Functions	9	56.3	1.00	0.75 -- 7.00	1.38
	230	Function Notation	8	50.0	0.50	0.75 -- 1.50	1.00
	231	Graphing Relations & Functions	9	56.3	1.00	0.75 -- 8.00	1.50
	232	Composition of Functions	4	25.0	1.00	0.75 -- 1.50	1.00
	233	Inverse of a Relation	3	18.8	1.50	0.75 -- 1.00	0.88
	234	Finding the Value of a Function by Linear Interpolation	1	6.3	0.50	----	----
	270	Solving Equations with Fractions, Variables in Exponent	4	25.0	1.50	2.00 -- 3.00	3.00
	271	Meaning of the Exponential Function & Its Graph	5	31.3	2.00	0.75 -- 4.00	1.00
	272	Inverse of Exponential Function: The Logarithmic Function	4	25.0	1.50	0.60 -- 1.00	0.75
	278	Solving Exponential & Logarithmic Equations	3	18.8	1.50	0.60 -- 2.00	0.75
	279	Applying Logarithms to Problems Involving Growth	4	25.0	2.00	0.60 -- 3.00	2.00
		TOTALS	688		110.25		126.11

TABLE 13

TRIGONOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES		HOURS		
			N	%	STANDARD	RANGE	MEDIAN
II	147	The Tangent Ratio	13	81.3	0.50	0.50 -- 3.00	1.00
	148	Solving Problems Using the Tangent Ratio	13	81.3	1.00	0.25 -- 4.00	1.75
	149	The Sine & Cosine Ratios	13	81.3	0.50	0.25 -- 3.00	1.25
	150	Solving Problems Using the Sine & Cosine Ratios	13	81.3	1.00	0.60 -- 4.00	1.88
	151	Finding Lengths or Angles in Geometric Figures	10	62.5	1.00	0.60 -- 4.00	2.00
	152	Using Trigonometry to Find the Area of a Polygon	8	50.0	1.00	0.60 -- 2.00	1.00
III	251	Finding Sides & Angles of Right Triangle Using Trigonometry	12	75.0	1.50	0.60 -- 5.00	3.00
	252	Trigonometric Values of 30°, 45°, & 60°	10	62.5	1.00	0.50 -- 2.00	1.25
	253	Standard Position of an Angle	9	56.3	0.50	0.50 -- 2.00	1.00
	254	Radian Measure	6	37.5	1.00	0.60 -- 2.00	1.00
	255	Definitions of Sin, Cos & Tan of Angle in Standard Position	10	62.5	1.00	0.60 -- 3.00	1.50
	256	Finding Trig Functions of Angle Given Value of 1 Trig Functn	6	37.5	0.50	0.60 -- 2.00	1.25
	257	Graphing of $y = \sin x$ and $y = \cos x$	9	56.3	1.50	0.60 -- 4.00	1.00
	258	Graphing of $y = a \sin x$ and $y = a \cos x$	7	43.8	0.50	0.60 -- 2.00	0.75
	259	Graphing of $y = a \sin bx$ and $y = a \cos bx$	7	43.8	1.50	0.60 -- 2.00	0.75
	260	Graphing of $y = \tan x$	5	31.3	0.50	0.60 -- 4.00	0.75
	261	Finding Cotangent, Cosecant & Secant	2	12.5	1.00	0.60 -- 2.50	1.55
	262	Finding Quotient & Pythagorean Identities	3	18.8	1.50	0.60 -- 2.50	1.75
	263	Proving Trigonometric Identities	1	6.3	2.00	3.50	3.50
	264	Solving Linear Trigonometric Equations	3	18.8	0.50	0.60 -- 1.50	0.75
	265	Solving Quadratic Trigonometric Equations	3	18.8	0.50	0.60 -- 1.50	0.75
	266	Solving Trig Equations with More Than One Function	3	18.8	1.00	0.60 -- 1.50	0.75
	267	Solving Trigonometric Equations to the Nearest Minute	3	18.8	0.50	0.60 -- 5.00	0.75

(Continued)

TABLE 13 (Continued)

TRIGONOMETRY TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
III	280	Deriving the Law of Sines	2	12.5	1.00	0.50 --1.00	0.75
	281	Using the Law of Sines	7	43.8	1.00	0.60 -- 4.00	2.00
	282	Using the Law of Sines Given Side-Side-Angle	4	25.0	0.50	0.60 -- 4.00	0.75
	283	Solving Trigonometric Problems Using the Law of Sines	6	37.5	1.00	0.60 -- 4.00	1.38
	284	Deriving the Law of Cosines	2	12.5	1.00	0.50 -- 2.00	1.25
	285	Using the Law of Cosines	7	43.8	1.00	0.60 -- 4.50	2.00
	286	Applying the Laws of Sines & Cosines to Right Triangles	7	43.8	2.00	0.60 -- 5.00	1.38
	287	Solving Parallelogram of Forces Problems	3	18.8	1.00	1.50 -- 2.00	1.50
	288	Using Sum & Difference Formulas for Sine & Cosine	1	6.3	1.00	0.75	0.75
	289	Using the Double Angle Formulas for Sine & Cosine	1	6.3	1.00	0.75	0.75
	290	Using the Half-Angle Formulas for Sine & Cosine	1	6.3	1.00	0.75	0.75
	291	Tangent Formulas for Sum, Difference, Double & Half-Angle	1	6.3	1.00	1.50	1.50
	292	Applying Trigonometric Formulas in Proving Identities	2	12.5	1.00	0.60 -- 2.50	1.55
	293	Applying Trig Formulas in Solving Trigonometric Equations	2	12.5	1.00	0.60 -- 2.00	1.30
	294	Evaluating Inverse Trigonometric Relations & Functions	2	12.5	1.50	0.60 -- 3.00	1.80
	295	Using Polar Coordinates	1	6.3	2.00	2.00	2.00
		TOTALS	218		39.50		60.33

TABLE 14

OTHER TOPICS

TOPICS IN SEQUENTIAL MATH COURSES COVERED IN TECH-PREP MATH CURRICULA

COURSE & ITEM NO.		TOPICS	YES N	YES %	HOURS STANDARD	HOURS RANGE	HOURS MEDIAN
I	18	Exploration & Insight Into Problem Exploration Strategies	14	87.5	3.00	1.50 - 25.00	8.25
	89	Preparation for Regents Examination	0	0.0	4.00	----	----
III	311	Sequences	2	12.5	1.00	0.75 -- 1.00	0.88
	312	Arithmetic Sequences	2	12.5	1.00	0.75 -- 1.00	0.88
	313	Arithmetic Series	2	12.5	1.00	0.75 -- 1.00	0.88
	314	Geometric Sequences	2	12.5	0.50	0.75 -- 1.00	0.88
	315	Geometric Series	2	12.5	0.75	0.75 -- 1.00	0.88
	316	Sum of an Infinite Geometric Series	1	6.3	1.00	0.75	0.75
		TOTALS	25		12.25		13.38

TABLE 15

TOPICS FROM SEQUENTIAL MATH COURSES WHICH WERE MOST OFTEN AND LEAST OFTEN COVERED IN 16 CATEGORY A TECH-PREP MATH CURRICULA

TOPICS IN 12 (75%) OR MORE CURRICULA

Subj	Topic No.	Topic
LOG	2	Sentences, Statements & Open Sentences
NUM	1	Numbers & Their Names
	9	Introduction to Real Numbers
	35	Introduction to Square Roots
	74	Ordered Pairs in a Coordinate System
	269	Using Scientific Notation to Write Numbers
OPS	10	Addition of Real Numbers
	11	Subtraction of Real Numbers
	12	Identity Elements & Inverses
	13	Assoc Addition, Distrib Multiplic, Order of Opers
	14	Multiplication of Real Numbers
	15	Associativity
	16	Commutativity
	17	Applications of the Laws of Algebra
	21	Division of Real Numbers
	22	Laws of Exponents
GEO	58	Angles Rels: Supplementry, Complemntry, Vertical
	59	Classifying Triangles by Side Lngth & Angle Meas
	60	The Pythagorean Theorem
	61	Circles
	62	Rels of Straight Lines in Plane: Parallel & Intersctg
	63	Making Inferences About Given Parallel Lines
	65	Classification of Quadrilaterals: Side Parallelism
	73	Review of Analytic Geometry
	99	Basic Terminology of Angles & Angle Measurement

TOPICS IN 4 (25%) OR FEWER CURRICULA

Subj	Topic No.	Topic
LOG	55	Symbolic Logic Related to Conditional Statements
	56	Conditnal Statemnts: Inverse, Converse, Contrapos
	91	Laws of Logic
	92	Apply Laws of Logic to Test Validity of Argument
	93	Laws of Syllogism & Disjunctive Inference
	95	Use Logic Laws to Write More Complicatd Proofs
	96	Role of Quantifiers
	97	Foundations of an Axiomatic System
	109	Formal Proof
	161	Prove Geometric Relatns with Coordinate Geometry
	162	Prove General Theorems with Coordinate Geometry
	317	Principle of Mathematical Induction
NUM	223	Imaginary Numbers
	224	Properties of Complex Numbers
OPS	192	Linear & Circular Seating Problems
	225	Dividing Complex Numbers
	273	Finding the Logarithm of a Number
	274	Using Common Logarithm Tables
	275	Finding the Logarithm of a Product
	276	Finding the Logarithm of a Quotient
	277	Finding the Logarithm of a Power or Root
GEO	57	Methods of Determining Congruent Triangles
	110	Congruent Polygons
	111	Side-Angle-Side Proofs
	112	Angle-Side-Angle & Side-Side-Side

TABLE 15 (Continued)

TOPICS IN 12 (75%) OR MORE CURRICULA

Subj	Topic No.	Topic
GEO	100	Different Types of Angle Pairs
	106	Congruent Angles
	107	Perpendicular Lines & Altitudes
	108	Bisectors & Midpoints
	115	Isosceles Triangles
	120	Perpendicular Lines
	121	Parallel Lines
	124	Sum of the Measures of the Angles in a Triangle
	131	Properties of a Parallelogram
	137	Ratios & Proportions
	144	Apply the Pythagorean Theorem
	145	30°-60°-90° Triangle
	146	45°-45°-90° Triangle
	157	Slopes of Parallel & Perpendicular Lines
	241	Parts of a Circle
MEA	67	Finding Areas of Polygonal Regions
	88	Volume
	156	The Slope Formula
PRB	24	What is Probability?
	25	Why Do We Introduce Sample Space?
	27	How Do We Apply Probability to Real Life?
	68	Introduction to Statistics
	69	Data Tables
	70	Graphs & Histograms
	71	Measures of Central Tendency
	72	Grouped Data
	188	Simple Probability Problems
	303	Finding Measures of Central Tendency
	304	Finding Measures of Dispersion
ALG	19	Express Relations with Variables & Open Sentences
	20	Monomials

TOPICS IN 4 (25%) OR FEWER CURRICULA

Subj	Topic No.	Topic
GEO	113	More Difficult Congruent Triangles
	114	Corresponding Parts of Congruent Triangles
	117	Prove Overlapping Triangles are Congruent
	118	More Difficult Overlapping Triangle Proofs
	119	Using Two Pair of Congruent Triangles in a Proof
	122	Prove That Lines are Parallel
	125	Prove Triangles Congruent
	126	Converse of Isosceles Triangle Theorem
	127	Prove Right Triangles are Congruent
	129	Formulas Concerning Interior Angles
	130	Formulas Concerning Exterior Angles
	132	Prove That a Quadrilateral is a Parallelogram
	133	Prove That a Quadrilateral is a Rectangle
	134	Prove That a Quadrilateral is a Rhombus
	135	Prove That a Quadrilateral is a Square
	136	Prove That Quadrilateral is an Isosceles Trapezoid
	139	Prove That Triangles are Similar
	140	Prove That Line Segments are in Proportion
	141	Prove That Products of Line Segments are Equal
	165	Five Basic Loci
	166	Geometric Applications of Locus
	167	Finding a Locus by Construction
	168	Intersection of Loci
	171	Locus of Points Equidistant from 3 Non-collinr Pnts
	235	Transformational Geometry
	242	Proving Arcs & Chords Congruent
	243	Proving Chords Congruent
	246	Measuring Angles: Tan-Chord, 2 Tans, 2 Secants...
	247	Measuring an Angle Formed by Two Chords
	250	Constructions Related to the Circle
	306	Composition of Transformations

TABLE 15 (Continued)

TOPICS IN 12 (75%) OR MORE CURRICULA

Subj	Topic No.	Topic
ALG	23	Multiplication of Monomials
	30	Solution of Linear Equats Involving 1 Operatn
	31	Solution of Linear Equats Involving 2 Operatns
	32	Solving Linear Inequalities Invlvng 1 Operation
	33	Adding & Subtracting Polynomials
	34	Multiplying a Polynomial by a Monomial
	40	Introduction to Quadratic Equations
	41	Solving Quadratic Equats in Form: Product =0
	42	Introduction to Factoring
	43	Multiplying Binomials
	45	Verbal Problems Leading to Quadratic Equats
	75	Slope of a Straight Line
	76	Equation of a Straight Line
	77	Graphing a Linear Equation
	78	Graphic Solution of System of 2 Linear Equats
	79	Graphing a Linear Inequality
	80	Graphic Solutn of Systm of Linear Inequalities
	81	Algebraic Solution of System of Linear Equats
	158	Graphing Linear Function
	160	Slope-Intercept Form of the Equation of a Line
	187	Word Probs Which Lead to Quadratic Equats
	206	Solving First Degree Equations
	207	Solving Verbal Problems
TRG	147	The Tangent Ratio
	148	Solving Problems Using the Tangent Ratio
	149	The Sine & Cosine Ratios
	150	Solving Problems Using Sine & Cosine Ratios
	251	Finding Sides & Angles of Right Triangle with Trig
OTH	18	Exploration & Insight into Problem Strategies

TOPICS IN 4 (25%) OR FEWER CURRICULA

Subj	Topic No.	Topic
GEO	307	Geometric Transformations with Mathemtcl Systms
	308	Glide Reflection
	309	Isometrics
	310	Similarity Transformations
PRB	26	What are Relationships Betwn Logic & Probability?
	190	Permutations with Repetitions
	194	Applying Combinations to Counting
	195	Applying Combinations to Geometry
	196	Using Combinations to Solve Probability Problems
	197	More Difficult Problems in Counting & Probability
	296	Tree Diagrams for Probabilities in 2+ Stage Expers
	297	Solving Conditional Probability Problems
	298	Probability of an Event in Sequence of Indep Trials
	299	Use Binomial Theorem to Solve Probability Problms
	300	Experimentl Data to Determine/Verify Probabilities
	301	Using Summation Notation
ALG	6	Logic, Graphs & Solution Sets
	7	Using Logic to Help Solve Inequalities
	104	Addition & Reflexive Properties
	105	Subtraction Property
	169	Equation of a Locus
	172	Finding Equations of Locus in the Coordinate Plane
	174	Intersection of Loci in the Coordinate Plane
	180	Completing the Square
	181	Deriving the Quadratic Formula
	182	Nature of the Roots of a Quadratic Equation
	183	Rel Betwn Coefficient & Roots of Quadratic Equat
	184	Finding Points of Intersection of a Parabola & Line
	185	Solve Other Quadratic-Linear Systems Graphically
	186	Solving Quadratic-Linear Systems Algebraically
	198	Identity, Inverse & Closure

TABLE 15 (Continued)

TOPICS IN 4 (25%) OR FEWER CURRICULA

Subj	Topic No.	Topic
ALG	200	Clock Arithmetic
	201	Definition of a Group
	202	Groups in Mathematical Systems
	203	Definition of a Field
	211	Solving Absolute Value Inequalities
	217	Simplifying Complex Fractions
	218	Solving Fractional Equations
	226	Nature of the Roots of a Quadratic Equation
	227	Sum & Product of Roots of Quadratic Equat
	232	Composition of Functions
	233	Inverse of a Relation
	234	Find Value of Function by Linear Interpolation
	270	Solve Equats with Fractions/Variables in Expnt
	272	Inverse of Exponentl Functn: Logrthmc Functn
	278	Solving Exponential & Logaritmic Equations
	279	Applying Logarithms to Problems in Growth
TRG	261	Finding Cotangent, Cosecant, & Secant
	262	Finding Quotient & Pythagorean Identities
	263	Proving Trigonometric Identities
	264	Solving Linear Trigonometric Equations
	265	Solving Quadratic Trigonometric Equations
	266	Solving Trig Equats with More Than 1 Functn
	267	Solving Trig Equations to the Nearest Minute
	280	Deriving the Law of Sines
	282	Using the Law of Sines Given Side-Side-Angle
	284	Deriving the Law of Cosines
	287	Solving Parallelogram of Forces Problems
	288	Use Sum & Diffrnce Formulas for Sine & Cos

TABLE 15 (Continued)

LOG = Logic Topics
NUM = Number Sense & Numeration Concepts Topics
OPS = Operations on Number Topics
GEO = Geometry Topics
MEA = Measurement Topics
PRB = Probability & Statistics Topics
ALG = Algebra Topics
TRG = Trigonometry Topics
OTH = Other Topics Not Included Above

TOPICS IN 4 (25%) OR FEWER CURRICULA

Subj	Topic No.	Topic
TRG	289	Use Double Angle Formulas for Sine & Cosine
	290	Use Half-Angle Formulas for Sine & Cosine
	291	Tangent Formulas: Sum, Diff, Double, ½ Angl
	292	Apply Trig Formulas in Proving Identities
	293	Apply Trig Formulas in Solving Trig Equations
	294	Evaluating Inverse Trig Relations & Functions
	295	Using Polar Coordinates
OTH	89	Preparation for Regents Examination
	311	Sequences
	312	Arithmetic Sequences
	313	Arithmetic Series
	314	Geometric Sequences
	315	Geometric Series
	316	Sum of an Infinite Geometric Series

TABLE 16

ADDITIONAL TOPICS COVERED IN TECH-PREP MATH CURRICULA AS REPORTED BY RESPONDENTS

SUBJECT	TOPIC
MATHEMATICS	3 Equations, 3 Unknowns (Listed by 1 A, 1 B)
	Matrices (1 A)
	Surface Area (1 A)
	3 Dimensional Shapes (1 A, 1 B)
	Application of Statistics (1 A)
	Designing a Statistical Study (1 A, 1 B)
	Applications of Formulae (1 A)
	Inverse Proportions (1 A)
	*Ratios & Proportions (1 A)[Topic 137]
	*2 Equations, 2 Unknowns (1 B)[Topics 78, 81]
	Topics in Jr. High School Math (1 A)
	Binary Numbers (1 A)
	*Systems of Inequality -- Graphically (1 B)[Topic 80]
	Exponents (1 B)
	Constructing Models in Geometry & Trigonometry (1 B)
	*Area of Any Triangle (1 C)[Topic 67]
	Piece-wise Function (1 C)
COMPUTERS & CALCULATORS	Computer Spreadsheets for Statistics (1 A)
	Computer Spreadsheets -- General (1 A)
	Using Scientific Calculators (1 A, 1 B, 1 C)
	Computer Graphics (1 A)
	Using Computer Graphics to Solve Practical Problems (1 A)
	Using Scientific Calculator for Linear Regression, Linear Programming, Quadratic Progression (1 C)
MEASUREMENT SYSTEMS & INSTRUMENTATION	Converting Measurements (1 A)
	Using Vernier & Micrometer Calipers (1 A)
	Using Stopwatches, Rulers & Line Levels (1 A)
	Metric & English Measurement Systems (1 A)
	English -- Metric Conversion (1 B)
COMMUNICATION & CAREER EDUCATION	Oral & Written Presentations (1 A)
	Communication (1 B)
	Career Exploration (1 A, 1 B)

(Continued)

TABLE 16 (Continued)

ADDITIONAL TOPICS COVERED IN TECH-PREP MATH CURRICULA AS REPORTED BY RESPONDENTS

SUBJECT	TOPIC
TECHNOLOGY	Precision, Accuracy and Tolerances (1 A, 1 B)
	Drawing Detailed Scale Drawings (1 A, 1 B)
	Quality Assurance & Process Control (1 A)
	Outdoor Surveying (1 A)
	Outdoor Design Mapping (1 A)
	Using Drawing Instruments (1 A)
	AND/OR Gates in Electronics (1 A)
	Euler Circuits (1 A)
	Survey Taking & Data Analysis in Health Careers (1 A)
	Measurements in Health Careers (1 A)
MISCELLANEOUS	Preparation for RCT Examination (1 A)
	Managing Personal Finances (1 A)
	Map Coloring (1 A)
	Graph Coloring (1 A)

* Denotes Topics Reported as Additional Which Were Listed in Questionnaire

TABLE 17

INSTRUCTIONAL MATERIALS IN TECH-PREP MATH CURRICULA AS REPORTED BY RESPONDENTS

TEXTBOOKS

Algebra 2. Larson, R., Kanold, T & Stiff, L. Heath. Lexington, MA. 1993.

Curriculum & Evaluation Standards for School Mathematics, Addenda Series, Grades 9--12. National Council of Teachers of Mathematics. Reston, VA. 1995.

Elementary Algebra for College Students. Angel, A. Prentice-Hall. 1991.

Integrated Math Course I. Dressler, I. & Keenan, E. Amsco School Publishing, Inc. New York. 1980.

Integrated Math Course II. Keenan, E. & Dressler, I. Amsco. New York. 1980.

Integrated Math Course III. Keenan, E. & Ganter, A. Amsco. New York. 1980

Integrated Mathematics Course I. Kelly, B., Atkinson, P., & Alexander, B. McDougal, Littell & Co. Evanston, IL. 1991.

Integrated Mathematics Course II. Kelly, B., Atkinson, P., & Alexander, B. McDougal, Littell & Co. Evanston, IL. 1991.

Math Connections. Gardella, F. Houghton-Mifflin, 1992.

Mathematics: A Topical Approach. Bumby, D. & Klutch, R. C. E. Merrill Publishing Co. Columbus, OH. 1986.

Mathmatters. Lynch, C. & Olmstead, E. South Western Publishing Co. Cincinnati, OH. 1993.

Practical Problems in Mathematics for Electronics Technicians. Herman, S. & Sullivan, R. Delmar Publishing Co. Albany. 1995.

CENTER FOR OCCUPATIONAL RESEARCH & DEVELOPMENT MATERIALS

Dividing the 40 Units of *CORD Applied Mathematics* into One-Year Courses.

9th Grade (15 units)

Unit	
A.	Getting to Know Your Calculator
B.	Naming Numbers in Different Ways
C.	Finding Answers with Your Calculator
1.	Learning Problem-solving Techniques
2.	Estimating Answers
3.	Measuring in English and Metric Units
4.	Using Graphs, Charts, and Tables
5.	Dealing with Data
6.	Working with Lines and Angles
7.	Working with Shapes in Two Dimensions
8.	Working with Shapes in Three Dimensions
9.	Using Ratios and Proportions
10.	Working with Scale Drawings
11.	Using Signed Numbers and Vectors
12.	Using Scientific Notation

10th Grade (13 units)

Unit	
13.	Precision, Accuracy, and Tolerance
14.	Solving Problems with Powers and Roots
15.	Using Formulas to Solve Problems
16.	Solving Problems That Involve Linear Equations
17.	Graphing Data
18.	Solving Problems That Involve Nonlinear Equations
19.	Working with Statistics
20.	Working with Probabilities
23.	Factoring
24.	Patterns and Functions
25.	Quadratics
26.	Systems of Equations
27.	Inequalities

11th Grade (12 units)

Unit	
21.	Using Right-triangle Relationships
22.	Using Trigonometric Functions
28.	Geometry in the Workplace 1
29.	Geometry in the Workplace 2
30.	Solving Problems with Computer Spreadsheets
31.	Solving Problems with Computer Graphics
32.	Quality Assurance and Process Control 1
33.	Quality Assurance and Process Control 2
34.	Logic (new unit)
35.	Spatial Visualization (new unit)
36.	Coordinate Geometry (new unit)
37.	Transformations (new unit)

CORD Applied Mathematics
A CONTEXTUAL APPROACH TO INTEGRATED MATHEMATICS

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TABLE 18

PERCENT AGREEMENT WITH NEW YORK STATE FRAMEWORK MATHEMATICS STATEMENTS BY CATEGORY AND BY SUBJECT AREA

		PERCENT AGREEMENT				
		A		B		ABCD
	No. OF FRAMEWK	(N = 16)		(N = 5)		(N = 27)
SUBJECT	STATEMNTS	% RANGE	% MEDN	% RANGE	% MEDN	% MEDN
LOG	8	0 -- 100	43.8	0 -- 100	75.0	50.0
NUM	8	62.5 -- 100	100	75.0 -- 100	100	100
OPS	11	63.6 -- 100	100	81.8 -- 100	100	100
GEO	13	23.1 -- 100	76.9	30.8 -- 100	92.3	76.9
MEA	12	25.0 -- 100	95.8	25.0 -- 100	91.7	91.7
PRB	22	0.0 -- 100	65.9	0.0 -- 95.5	86.4	86.4
ALG	13	46.2 -- 100	96.1	92.3 -- 100	92.3	100
TRG	5	0.0 -- 100	100	0.0 -- 100	100	100
TOTAL	92	37.0 -- 98.9	86.5	38.0 -- 95.7	90.6	85.9

Category A = Tech-Prep curricula with no standard sequential courses
Category B = Tech-Prep curricula which include Sequential Course I
Category C = Tech-Prep curricula which include Sequential Courses I & II
Category D = Tech-Prep curricula which include Sequential Courses I, II & III

LOG = Logic Statements
NUM = Number Sense & Numeration Concepts Statements
OPS = Operations on Number Statements
GEO = Geometry Statements
MEA = Measurement Statements
PRB = Probability & Statistics Statements
ALG = Algebra Statements
TRG = Trigonometry Statements

FIGURE 3

PERCENTAGE OF TOPICS IN SEQUENTIAL MATH COURSES WHICH ARE COVERED IN A TECH-PREP CURRICULUM VS. PERCENTAGE AGREEMENT WITH STATE FRAMEWORK MATH STATEMENTS FOR EACH TECH-PREP CURRICULUM

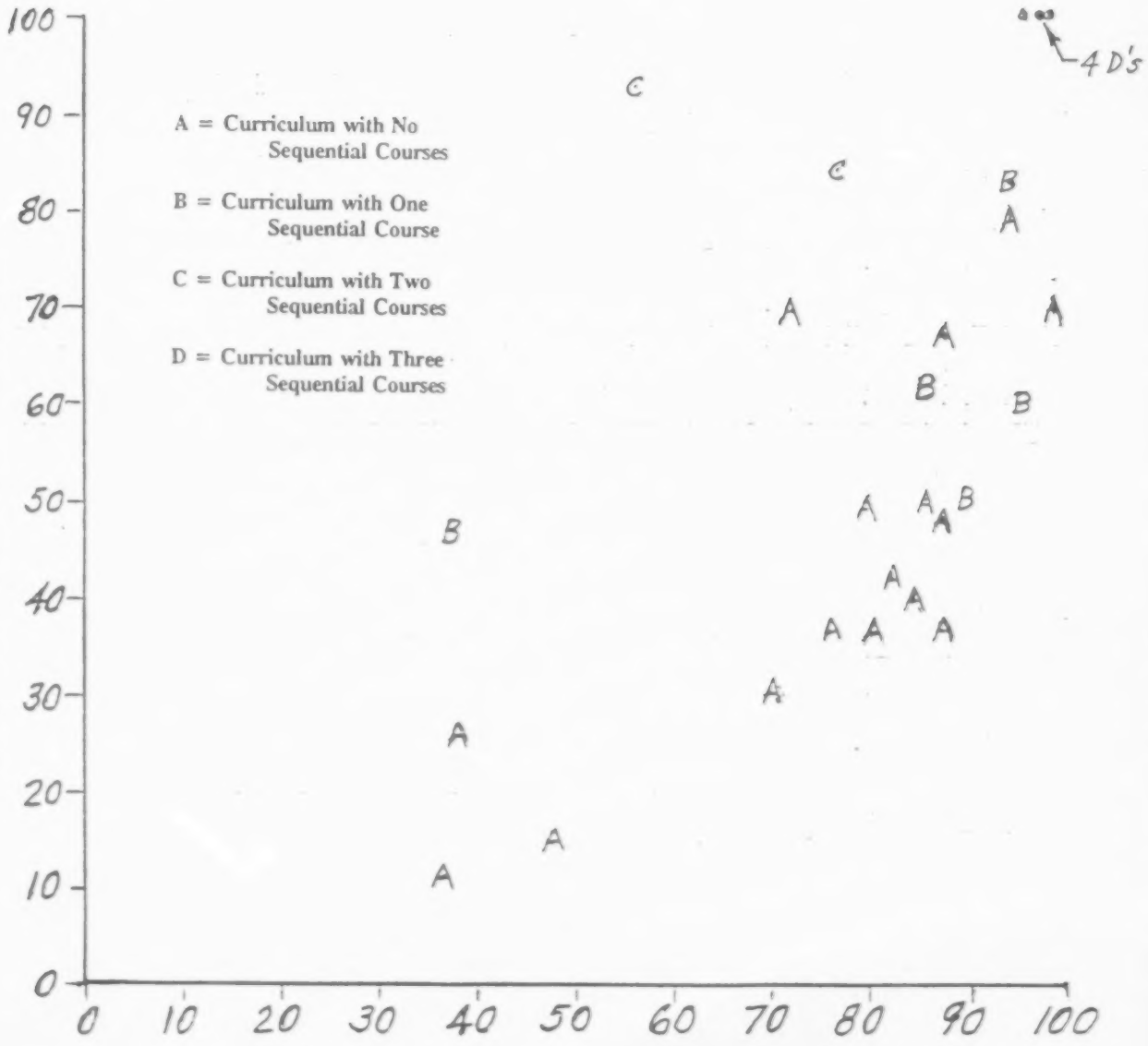

TABLE 19

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON LOGIC

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Recognize & apply deductive reasoning	7	43.8	7	2	8	72.7	3	0
	Understanding & apply reasoning processes	10	62.5	5	1	8	72.7	3	0
	Make & evaluate math conjectures & arguments	8	50.0	8	0	6	54.5	4	1
	Appreciate the use & power of reasoning	11	68.8	4	1	8	72.7	2	1
	Sub-Total	36		24	4	30		12	2
COMMEN	Recognize & apply inductive reasoning	6	37.5	8	2	8	72.7	3	0
	Make & test conjectures	9	56.3	5	2	7	63.6	3	1
	Follow & judge validity of logical arguments	5	31.3	9	2	8	72.7	3	0
	Construct simple arguments, using laws of logic	3	18.8	11	2	7	63.6	4	0
	Sub-Total	23		33	8	30		13	1
	TOTAL	59		57	12	60		25	3

TABLE 20

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON NUMBER SENSE & NUMERATION CONCEPTS

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Construct number meanings: fractions, decimals, integers	16	100	0	0	11	100	0	0
	Extend numeration concepts: fractions, decimals, integers	16	100	0	0	11	100	0	0
	Develop concepts of ratio, proportion, percent	16	100	0	0	10	90.9	1	0
	Apply & solve problems using ration, proportion, percent	16	100	0	0	10	90.9	1	0
	Sub-Total	64		0	0	42		2	0
COMMEN	Construct number meanings for all real numbers	12	75.0	4	0	9	81.8	0	2
	Understand structure/development of real number system	9	56.3	5	2	10	90.9	0	1
	Rel/apply numeration concepts to other areas in curriculum	14	87.5	1	1	10	90.9	0	1
	Use numeration concepts to solve wide range of problems	16	100	0	0	10	90.9	0	1
	Sub-Total	51		10	3	39		0	5
	TOTAL	115		10	3	81		2	5

TABLE 21

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON OPERATIONS ON NUMBER

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Use fractions, decimals, integers	16	100	0	0	11	100	0	0
	Model/explain/develop proficiency with basic algorithms	15	93.8	1	0	10	90.9	0	1
	Use concrete materials for ops with fractns, decims, integs	13	81.3	0	3	9	81.8	0	2
	Apply algorithms & order of ops rule to routine calclatns	15	93.8	1	0	11	100	0	0
	Estimate to check results from algorithms or technology	14	87.5	1	1	10	90.9	1	0
	Solve variety of problems with integers, fractions, decimals	16	100	0	0	11	100	0	0
	Sub-Total	89		3	4	62		1	3
COMMEN	Calculate with real numbers using variety of techniques	14	87.5	1	1	11	100	0	0
	Select & use the appropriate method for computing	16	100	0	0	10	90.9	0	1
	Analyze & solve problems with multiple computatnl skills	16	100	0	0	11	100	0	0
	Use estimation to approximate solution to problems	14	87.5	0	2	9	81.8	1	1
	Solve variety of complex probs with real number system	13	81.3	1	2	11	100	0	0
	Sub-Total	73		2	5	52		1	2
	TOTAL	162		5	9	114		2	5

TABLE 22

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON GEOMETRY

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Explore ways in which geometry is used in the real world	16	100	0	0	10	90.9	1	0
	Use transformations to see preservation of size &/or shape	9	56.3	6	2	9	81.8	2	0
	Classify 2- & 3-dimensional figures on particular attributes	15	93.8	1	0	8	72.7	1	2
	Construct geometric conclusions using logical reasoning	4	25.0	10	2	8	72.7	1	2
	Use geom ideas to analyze probs involving geom concepts	10	62.5	4	2	10	90.9	1	0
	Sub-Total	54		21	6	45		6	4
COMMEN	Relate geometric principles to real-world phenomena	14	87.5	2	0	10	90.9	1	0
	Show undrstndg of transformations: congruence, similarity	9	56.3	5	2	9	81.8	1	1
	Analyze patterns in 2 & 3 dimensions	12	75.0	3	1	7	63.6	1	3
	Construct convincing arguments using geometric concepts	8	50.0	8	0	7	63.6	1	3
	Apply geometric ideas in the solution of problems	13	81.3	3	0	9	81.8	1	1
	From assumptns, deduce props of & reltn betwn geom figs	12	75.0	4	0	7	63.6	2	2
	Make coord representatns of geometric figures & concepts	12	75.0	4	0	7	63.6	4	0
	Deduce props of figures using transfrmatns & coordinates	4	25.0	11	1	7	63.6	4	0
	Sub-Total	84		40	4	71		15	10
	TOTAL	138		61	10	116		21	14

TABLE 23

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON MEASUREMENT

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Know measurements can be to specific degree of accuracy	15	93.8	0	1	10	90.9	1	0
	Select appropriate tools to measure degree accuracy desired	15	93.8	1	0	9	81.8	2	0
	Measure & compute in both English & metric systems	15	93.8	0	1	10	90.9	1	0
	Informally derive and use formulas in measurement activs	15	93.8	1	0	9	81.8	2	0
	Solve wide array of problems using measurement concepts	15	93.8	1	0	10	90.9	1	0
	Compute quantities: area & volume using standard units	16	100	0	0	11	100	0	0
	Sub-Total	91		3	2	59		7	0
COMMEN	Rel measrmt precision with calc accuracy using measuremts	13	81.3	2	1	8	72.7	3	0
	Use instrumnts & procedures to make indirect measuremts	12	75.0	3	1	8	72.7	2	1
	Use dimensional analysis in problems involving measures	13	81.3	2	1	8	72.7	2	1
	Validate formulas used to compute measurements	8	50.0	4	4	7	63.6	2	2
	Solve wide array of probs in math, science & tech curric	15	93.8	1	0	10	90.9	0	1
	Compare rels of perimtr, area, vol of variable size figures	14	87.5	1	1	10	90.9	1	0
	Sub-Total	75		13	8	51		10	5
	TOTAL	166		16	10	110		17	5

TABLE 24

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON PROBABILITY & STATISTICS

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Distinguish between empirical & theoretical probabilities	10	62.5	6	0	9	81.8	1	1
	Devise/conduct experiments/simulatns to find probabilities	9	56.3	7	0	10	90.9	1	0
	Use probab model to compare results with math expectatns	10	62.5	6	0	8	72.7	1	2
	Make predictions	11	68.8	5	0	9	81.8	1	1
	Appreciate the pervasive use of probability in real world	10	62.5	6	0	9	81.8	1	1
	Collect, organize, describe, interpret grouped & indiv data	13	81.3	3	0	10	90.9	1	0
	Use sampling in statistical studies	13	81.3	3	0	10	90.9	1	0
	Use measures of central tendencies to analyze data	14	87.5	2	0	10	90.9	1	0
	Extrapolate info from data set in numeric or graphic form	14	87.5	1	1	9	81.8	1	1
	Sub-Total	104		39	1	84		9	6

(Continued)

TABLE 24 (Continued)

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON PROBABILITY & STATISTICS

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
COMMEN	Use probability to represent & solve chance problems	10	62.5	6	0	9	81.8	1	1
	Create & interpret discrete probability distributions	9	56.3	7	0	7	63.6	3	1
	Understand the concept & use of randomness	9	56.3	7	0	10	90.9	1	0
	Use computer & other simulations to estimate probabilities	5	31.3	9	2	4	36.4	1	5
	Understand a normal distribution	12	75.0	4	0	10	90.9	1	0
	Solve problems involving probability concepts	10	62.5	6	0	8	72.7	1	2
	Know that as experimntl n incrses probab nears theoreticl	8	50.0	7	1	7	63.6	2	2
	Design/conduct statistcl studies: interpret/communic results	11	68.8	5	0	9	81.8	1	1
	Draw inferences from data in charts, tables and graphs	14	87.5	2	0	10	90.9	1	0
	Differentiate between normally distributed & skewed data	10	62.5	6	0	8	72.7	2	1
	Appreciate statistical methods as means of decision making	11	68.8	3	2	10	90.9	1	0
	Determine measures of dispersion for a given set of data	11	68.8	5	0	10	90.9	1	0
	Use computer software to model data from the real world	8	50.0	7	1	6	54.5	3	2
	Sub-Total	128		74	6	108		19	15
	TOTAL	232		113	7	192		28	21

TABLE 25

RESPONSES TO FRAMEWORK MATHEMATICAL STATEMENTS ON ALGEBRA

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Model solution of simple equations using concrete materials	13	81.3	1	2	9	81.8	1	1
	Graph linear relationships	14	87.5	2	0	11	100	0	0
	Develop procedures for computing with integers	15	93.8	0	1	10	90.9	1	0
	Use variables	16	100	0	0	11	100	0	0
	Write & solve equations	15	93.8	1	0	11	100	0	0
	Compare direct & indirect variation	11	68.8	3	2	11	100	0	0
	Select/use approp technologies to investig algebraic concepts	14	87.5	1	1	10	90.9	0	1
	Sub-Total	98		8	6	73		2	2
COMMEN	Use algebraic & graphic techniques in solving equations	15	93.8	1	0	11	100	0	0
	Compare/contrast dir/indir variation, includg use of graphs	10	62.5	3	3	11	100	0	0
	Explore functions that depict real world phenomena	15	93.8	1	0	10	90.9	0	1
	Use algebraic techniques in the solution of problems	15	93.8	1	0	11	100	0	0
	Relate algebraic ideas to coordinate geometry	13	81.3	2	1	9	81.8	1	1
	Select/use approp technologies to solve algebraic problems	14	87.5	2	0	10	90.9	0	1
	Sub-Total	82		10	4	62		1	3
	TOTAL	180		18	10	135		3	5

TABLE 26

RESPONSES TO FRAMEWORK MATHEMATICS STATEMENTS ON TRIGONOMETRY

LEVEL	FRAMEWORK STATEMENT	CATEGORY A YES No.	CATEGORY A YES %	CATEGORY A NO No.	CATEGORY A ? No.	CATEGORIES BCD YES No.	CATEGORIES BCD YES %	CATEGORIES BCD NO No.	CATEGORIES BCD ? No.
INTERMED	Investigate relatnships among the sides of similar triangles	14	87.5	2	0	10	90.9	1	0
	Explore relatnships with similar triangles in problem solving	13	81.3	3	0	10	90.9	1	0
	Sub-Total	27		5	0	20		2	0
COMMEN	Rel consistnt ratios in similar right triangles to trig funtions	13	81.3	3	0	10	90.9	1	0
	Apply trigonometry to problems with right triangles	13	81.3	3	0	10	90.9	1	0
	Use calculators to get trigonometric functions of given angle	13	81.3	3	0	10	90.9	1	0
	Sub-Total	39		9	0	30		3	0
	TOTAL	66		14	0	50		5	0

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TABLE 27

STATE FRAMEWORK MATHEMATICS STATEMENTS WITH AGREEMENT BY 50 % OR FEWER OF THE RESPONDENTS

SUBJECT/ LEVEL	FRAMEWORK STATEMENT	CATEGORIES A % YES	CATEGORIES BCD % YES	CATEGORIES ABCD No. ?
LOG--COMMC	Construct simple arguments using laws of logic	18.8		
GEO--INTMD	Use geom ideas to analyze probs involving geom concepts	25.0		4
GEO--COMMC	Deduce props of figures using transfrmatns & coordinates	25.0		
LOG--COMMC	Follow & judge validity of logical arguments	31.3		
PRB--COMMC	Use computer & other simulations to estimate probabilities	31.3	36.4	7
LOG--COMMC	Recognize & apply inductive reasoning	37.5		
LOG--INTMD	Recognize & apply deductive reasoning	43.8		
LOG--INTMD	Make & evaluate math conjectures & arguments	50.0		
GEO--COMMC	Construct convincing arguments using geometric concepts	50.0		
MEA--COMMC	Validate formulas used to compute measurements	50.0		6
PRB--COMMC	Know that as experimntl n incrses probab nears theoreticl	50.0		
PRB--COMMC	Use computer software to model data from the real world	50.0		
OPS--INTMD	Use concrete materials for ops with fractns, decims, integs			5
GEO--COMMC	Analyze patterns in 2 & 3 dimensions			4

LOG = Logic Framework Statements
OPS = Operations on Number Framework Statements
GEO = Geometry Framework Statements
MEA = Measurement Framework Statements
PRB = Probability & Statistics Framework Statements

INTMD = Intermediate Level
COMMC = Commencement Level
No. ? = Number of Uncertain Responses